HKS

HKS Project No. 27487.000

Project Manual

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

DESIGN DEVELOPMENT

26 AUGUST, 2026

THIS PAGE INTENTIONALLY BLANK

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

PROJECT MANUAL

These documents are incomplete and are released for interim review only and are not intended for regulatory approval, permit, or construction purposes.

Architect: <UserField2>
Architect Registration No.: <UserField3>

<Affix Seal Here>

2026-08-26

TABLE OF CONTENTS

REVISED TECHNICAL CONTENT LEGEND

This font indicates added information from original issue.
~~This font indicates removed information from previous issue.~~
This font indicates previously added information.
~~This font indicates previously removed information.~~
This font indicates added information from previous revision.

ISSUANCE LOG:

Date of Issue:	Issue Title:
2026-08-26	Design Development

LEGEND

First Column:		Current Date of Section
Second Column:	X	"X" indicates Section is Included in Current Issue
Third Column:		Section Number
Fourth Column:		Section Title
Fifth Column:		Section Author

DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS

2026-08-26	X	003100	AVAILABLE PROJECT INFORMATION
2026-08-26	X	005200	AGREEMENT FORM
2026-08-26	X	007200	GENERAL CONDITIONS
2026-08-26	X	007300	SUPPLEMENTARY CONDITIONS

DIVISION 01 — GENERAL REQUIREMENTS

2026-08-26	X	010510	EXTERIOR DESIGN SELECTIONS
2026-08-26	X	010520	INTERIOR DESIGN SELECTIONS
2026-08-26	X	011000	SUMMARY
2026-08-26	X	012100	ALLOWANCES
2026-08-26	X	012200	UNIT PRICES
2026-08-26	X	012300	ALTERNATES
2026-08-26	X	012500	SUBSTITUTION PROCEDURES
2026-08-26	X	012600	CONTRACT MODIFICATION PROCEDURES
2026-08-26	X	012900	PAYMENT PROCEDURES
2026-08-26	X	013100	PROJECT MANAGEMENT AND COORDINATION
2026-08-26	X	013200	CONSTRUCTION PROGRESS DOCUMENTATION
2026-08-26	X	013233	PHOTOGRAPHIC DOCUMENTATION
2026-08-26	X	013300	SUBMITTAL PROCEDURES
2026-08-26	X	014000	QUALITY REQUIREMENTS
2026-08-26	X	014200	REFERENCES
2026-08-26	X	014323	SPECIAL INSPECTIONS
2026-08-26	X	014339	VISUAL MOCKUPS
2026-08-26	X	014519	FIELD TESTING FOR AIR AND WATER LEAKAGE
2026-08-26	X	014541	PRECONSTRUCTION LABORATORY MOCKUP TESTING FOR BUILDING ENCLOSURE SYSTEMS
2026-08-26	X	015000	TEMPORARY FACILITIES AND CONTROLS

2026-08-26	X	016000	PRODUCT REQUIREMENTS	
2026-08-26	X	017300	EXECUTION	
2026-08-26	X	017419.13	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL	
2026-08-26	X	017700	CLOSEOUT PROCEDURES	
2026-08-26	X	017823	OPERATION AND MAINTENANCE DATA	
2026-08-26	X	017839	PROJECT RECORD DOCUMENTS	
2026-08-26	X	017846.13	EXTRA STOCK AND MAINTENANCE MATERIALS - ARCHITECTURAL	
2026-08-26	X	017910	DEMONSTRATION AND TRAINING	
2026-08-26	X	018112.13	HEALTH AND ENVIRONMENTAL PERFORMANCE REQUIREMENTS	
2026-08-26	X	018116.16	CONSTRUCTION REQUIREMENTS FOR VOCS	
2026-08-26	X	019113	GENERAL COMMISSIONING REQUIREMENTS	

DIVISION 02 — EXISTING CONDITIONS

NOT USED

CACHE MASTERS

2026-08-26
000110c - HKS NewStandard TOC

DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS

2026-03-31	X	000110C	TABLE OF CONTENTS	HKS

DIVISION 03 — CONCRETE

2026-08-26	X	031000	CONCRETE FORMING AND ACCESSORIES DD	
2026-08-26	X	032000	CONCRETE REINFORCING DD	
2026-08-26	X	033000	CAST-IN-PLACE CONCRETE DD	
2026-08-26	X	033543	POLISHED CONCRETE	

DIVISION 04 — MASONRY

2026-08-26	X	042100	MASONRY VENEER	
2026-08-26	X	042200	CONCRETE UNIT MASONRY	

DIVISION 05 — METALS

2026-08-26	X	051200	FL - STRUCTURAL STEEL FRAMING DD	
2026-08-26	X	051213	ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING	
2026-08-26	X	051250	BUCKLING RESTRAINED BRACES DD	

2026-08-26	X	053100	FL - STEEL DECKING DD
2026-08-26	X	054000	COLD-FORMED METAL FRAMING
2026-08-26	X	054300	SLOTTED CHANNEL FRAMING
2026-08-26	X	055000	METAL FABRICATIONS
2026-08-26	X	055113	METAL STAIRS
2026-08-26	X	055213	PIPE AND TUBE RAILINGS
2026-08-26	X	055300	METAL GRATINGS
2026-08-26	X	057300	ORNAMENTAL HANDRAILS AND RAILINGS

DIVISION 06 — WOOD, PLASTICS, AND COMPOSITES

2026-08-26	X	061053	MISCELLANEOUS ROUGH CARPENTRY
2026-08-26	X	061643	EXTERIOR GYPSUM SHEATHING
2026-08-26	X	064023	INTERIOR ARCHITECTURAL WOODWORK
2026-08-26	X	066100	SIMULATED STONE FABRICATIONS
2026-08-26	X	066400	PLASTIC (FRP) PANELING
2026-08-26	X	066413	TRANSLUCENT RESIN PANEL FABRICATIONS

DIVISION 07 — THERMAL AND MOISTURE PROTECTION

2026-08-26	X	071326	SHEET WATERPROOFING
2026-08-26	X	071800	TRAFFIC COATINGS
2026-08-26	X	071813	EPOXY TRAFFIC COATINGS
2026-08-26	X	071900	WATER REPELLENTS
2026-08-26	X	072100	THERMAL INSULATION
2026-08-26	X	072423	DIRECT APPLIED EXTERIOR FINISH SYSTEM (DEFS)
2026-08-26	X	072617	BELOW SLAB VAPOR RETARDERS
2026-08-26	X	074213	FORMED METAL WALL PANELS
2026-08-26	X	075013	SINGLE-PLY MEMBRANE ROOFING
2026-08-26	X	075216	MODIFIED BITUMINOUS MEMBRANE ROOFING
2026-08-26	X	076200	SHEET METAL FLASHING AND TRIM
2026-08-26	X	077200	ROOF ACCESSORIES
2026-08-26	X	078116	SPRAYED FIRE-RESISTIVE MATERIALS (SFRM)
2026-08-26	X	078413	PENETRATION FIRESTOPPING
2026-08-26	X	078446	FIRE RESISTIVE JOINT FIRESTOPPING
2026-08-26	X	079200	JOINT SEALANTS

DIVISION 08 — OPENINGS

2026-08-26	X	081113	HOLLOW METAL DOORS AND FRAMES

2026-08-26	X	081216	INTERIOR ALUMINUM FRAMES
2026-08-26	X	081416	SOLID CORE FLUSH WOOD DOORS
2026-08-26	X	081433	STILE AND RAIL WOOD DOORS
2026-08-26	X	083113	ACCESS DOORS AND FRAMES
2026-08-26	X	083213	SLIDING ALUMINUM-FRAMED GLASS DOORS
2026-08-26	X	083219	MEDICAL SLIDING ALUMINUM FRAMED DOORS
2026-08-26	X	083343	OVERHEAD COILING SMOKE AND FIRE CURTAINS
2026-08-26	X	083613	SECTIONAL OVERHEAD DOORS
2026-08-26	X	084110	INTERIOR STOREFRONT
2026-08-26	X	084113	INTERIOR FIRE-RATED GLAZING SYSTEMS
2026-08-26	X	084127	EXTERIOR ALL-GLASS STOREFRONTS
2026-08-26	X	084128	INTERIOR ALL-GLASS ENTRANCES AND STOREFRONTS
2026-08-26	X	084243	MEDICAL SPECIALTY SLIDING ENTRANCES
2026-08-26	X	084400	GLAZED ALUMINUM FRAMING SYSTEMS
2026-08-26	X	084513	TRANSLUCENT INSULATING PANEL ASSEMBLIES
2026-08-26	X	085619	SLIDING PASS-THRU WINDOWS
2026-08-26	X	087100	DOOR HARDWARE
2026-08-26	X	088000	GLAZING
2026-08-26	X	089100	WALL LOUVERS

DIVISION 09 — FINISHES

2026-08-26	X	090600	ROOM FINISH SCHEDULE
2026-08-26	X	092400	PORTLAND CEMENT PLASTERING
2026-08-26	X	092900	GYPSUM BOARD ASSEMBLIES
2026-08-26	X	093000	TILING
2026-08-26	X	095113	ACOUSTICAL PANEL CEILINGS
2026-08-26	X	095133	SUSPENDED METAL CEILINGS
2026-08-26	X	095426	SUSPENDED WOOD CEILINGS
2026-08-26	X	096500	RESILIENT FLOORING
2026-08-26	X	096513	RESILIENT BASE AND ACCESSORIES
2026-08-26	X	096603	PRECAST TERRAZZO FLOORING AT STAIRS
2026-08-26	X	096623	THIN-SET TERRAZZO FLOORING
2026-08-26	X	096723	RESINOUS FLOORING
2026-08-26	X	096800	CARPETING
2026-08-26	X	097200	WALL COVERINGS
2026-08-26	X	097213	TACKBOARD WALL COVERINGS
2026-08-26	X	098433	ACOUSTICAL WALL PANELS

2026-08-26	X	099100	PAINTING
2026-08-26	X	099600	HIGH-PERFORMANCE COATINGS

DIVISION 10 — SPECIALTIES

2026-08-26	X	101100	VISUAL DISPLAY BOARDS
2026-08-26	X	101400	INTERIOR SIGNAGE
2026-08-26	X	102113	TOILET COMPARTMENTS
2026-08-26	X	102613	WALL AND CORNER GUARDS
2026-08-26	X	102813	TOILET ACCESSORIES
2026-08-26	X	102819	SHOWER DOORS AND ENCLOSURES
2026-08-26	X	104400	FIRE-PROTECTION SPECIALTIES
2026-08-26	X	104450	AUTOMATED EXTERNAL DEFIBRILLATORS (AED)
2026-08-26	X	105113	METAL LOCKERS
2026-08-26	X	105116	WOOD LOCKERS

DIVISION 11 — EQUIPMENT

NOT USED

DIVISION 12 — FURNISHINGS

2026-08-26	X	122413	ROLLER WINDOW SHADES
2026-08-26	X	123553	LABORATORY CASEWORK
2026-08-26	X	123571	STAINLESS STEEL CASEWORK
2026-08-26	X	123661	SIMULATED STONE COUNTERTOPS
2026-08-26	X	124843	ENTRANCE FLOOR MATS
2026-08-26	X	129300	SITE FURNISHINGS

DIVISION 13 — SPECIAL CONSTRUCTION

2026-08-26	X	132817	BALLPARK NETTING AND SUPPORTS
2026-08-26	X	134900	RADIATION PROTECTION
2026-08-26	X	134923	RF MRI MODULAR SHIELDING ENCLOSURE

DIVISION 14 — CONVEYING EQUIPMENT

2026-08-26	X	142400	HYDRAULIC ELEVATORS
2026-08-26	X	149100	CHUTES

DIVISION 20 — MECHANICAL SUPPORT

NOT USED

DIVISION 21 — FIRE SUPPRESSION

2026-08-26	X	211000	WATER BASED FIRE SUPPRESSION SYSTEMS

DIVISION 22 — PLUMBING

2026-08-26	X	220500	COMMON WORK RESULTS FOR PLUMBING
2026-08-26	X	220516	EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING
2026-08-26	X	220517	SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
2026-08-26	X	220518	ESCUTCHEONS FOR PLUMBING PIPING
2026-08-26	X	220519	METERS AND GAUGES FOR PLUMBING PIPING
2026-08-26	X	220523	GENERAL-DUTY VALVES FOR PLUMBING PIPING
2026-08-26	X	220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
2026-08-26	X	220533	HEAT TRACING FOR PLUMBING PIPING
2026-08-26	X	220548	VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT
2026-08-26	X	220553	IDENTIFICATION FOR PLUMBING PIPES AND EQUIPMENT
2026-08-26	X	220719	PLUMBING PIPING INSUATION
2026-08-26	X	221116	DOMESTIC WATER PIPING
2026-08-26	X	221119	DOMESTIC WATER PIPING SPECIALTIES
2026-08-26	X	221316	SANITARY WASTE AND VENT PIPING
2026-08-26	X	221319	SANITARY WASTE AND VENT PIPING SPECIALTIES
2026-08-26	X	221413	FACILITY STORM DRAINAGE PIPING
2026-08-26	X	221423	STORM DRAINAGE PIPING SPECIALTIES
2026-08-26	X	224000	PLUMBING FIXTURES
2026-08-26	X	224716	PRESSURE WATER COOLERS
2026-08-26	X	226113	COMPRESSED-AIR PIPING FOR LABORATORY AND HEALTH CARE FACILITIES
2026-08-26	X	226213	VACUUM PIPING FOR LABORATORY AND HEALTH CARE FACILITIES
2026-08-26	X	226313	GAS PIPING FOR LABORATORY AND HEALTH CARE FACILITIES
2026-08-26	X	226710	PURE WATER PIPING

DIVISION 23 — HEATING VENTILATING AND AIR CONDITIONING

2026-08-26	X	230100	MECHANICAL REQUIREMENTS
2026-08-26	X	230500	COMMON WORK RESULTS FOR HVAC
2026-08-26	X	230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

2026-08-26	X	230516	EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING
2026-08-26	X	230517	SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
2026-08-26	X	230518	ESCUTCHEONS FOR HVAC PIPING
2026-08-26	X	230519	METERS AND GAUGES FOR HVAC
2026-08-26	X	230523	GENERAL-DUTY VALVES FOR HVAC PIPING
2026-08-26	X	230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
2026-08-26	X	230548	VIBRATION AND SEISMIC CONTROLS FOR HVAC
2026-08-26	X	230550	OPERATIONS AND MAINTENANCE OF HVAC SYSTEMS
2026-08-26	X	230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
2026-08-26	X	230593	TESTING ADJUSTING AND BALANCING FOR HVAC
2026-08-26	X	230713	DUCT INSULATION
2026-08-26	X	230716	HVAC EQUIPMENT INSULATION
2026-08-26	X	230719	HVAC PIPING INSULATION
2026-08-26	X	230900	BUILDING AUTOMATION SYSTEM
2026-08-26	X	231123	FACILITY NATURAL GAS PIPING
2026-08-26	X	232113	HYDRONIC PIPING
2026-08-26	X	232116	HYDRONIC PIPING SPECIALTIES
2026-08-26	X	232123	HYDRONIC PUMPS
2026-08-26	X	232513	WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS
2026-08-26	X	233001	COMMON DUCT REQUIREMENTS
2026-08-26	X	233113	METAL DUCTS
2026-08-26	X	233119	HVAC CASINGS
2026-08-26	X	233300	AIR DUCT ACCESSORIES
2026-08-26	X	233423	HVAC POWER VENTILATORS
2026-08-26	X	233600	AIR TERMINAL UNITS
2026-08-26	X	233713	DIFFUSERS, REGISTERS, AND GRILLES
2026-08-26	X	233714	FIXED LOUVERS
2026-08-26	X	233723	HVAC GRAVITY VENTILATORS
2026-08-26	X	235100	BREECHINGS, CHIMNEYS, AND STACKS
2026-08-26	X	235700	HEAT EXCHANGERS FOR HVAC
2026-08-26	X	236424	PACKAGED AIR-TO-WATER HEAT PUMP
2026-08-26	X	237313	CUSTOM AIR HANDLING UNITS
2026-08-26	X	238123	COMPUTER-ROOM AIR CONDITIONERS

2026-08-26	X	238124	COMPUTER ROOM DX RACK COOLING EQUIPMENT
2026-08-26	X	238216	HYDRONIC AIR COILS
2026-08-26	X	238239	CABINET UNIT HEATERS
2026-08-26	X	238240	PROPELLER UNIT HEATER
2026-08-26	X	238414	HUMIDIFIER

DIVISION 25 — INTEGRATED AUTOMATION

NOT USED

DIVISION 26 — ELECTRICAL

2026-08-26	X	260519	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
2026-08-26	X	260523	CONTROL VOLTAGE ELECTRICAL POWER CABLES
2026-08-26	X	260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
2026-08-26	X	260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
2026-08-26	X	260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
2026-08-26	X	260543	UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS
2026-08-26	X	260544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL SYSTEMS
2026-08-26	X	260548	SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
2026-08-26	X	260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
2026-08-26	X	260572	OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY
2026-08-26	X	260573	OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY
2026-08-26	X	260574	OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY
2026-08-26	X	260800	ELECTRICAL COMMISSIONING REQUIREMENTS
2026-08-26	X	260923	LIGHTING CONTROL DEVICES
2026-08-26	X	260936	STANDALONE MULTIPRESET MODULAR DIMMING CONTROLS
2026-08-26	X	260943	RELAY-BASED LIGHTING CONTROLS
2026-08-26	X	262200	LOW-VOLTAGE TRANSFORMERS
2026-08-26	X	262313	LOW-VOLTAGE PARALLELING SWITCHGEAR
2026-08-26	X	262413	SWITCHBOARDS

2026-08-26	X	262416	PANELBOARDS
2026-08-26	X	262726	WIRING DEVICES
2026-08-26	X	262813	FUSES
2026-08-26	X	262816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
2026-08-26	X	262913	ENCLOSED CONTROLLERS
2026-08-26	X	262923	VARIABLE FREQUENCY MOTOR CONTROLLERS
2026-08-26	X	263213	ENGINE GENERATORS
2026-08-26	X	263600	TRANSFER SWITCHES
2026-08-26	X	264113	LIGHTNING PROTECTION FOR STRUCTURES
2026-08-26	X	265119	LED INTERIOR LIGHTING
2026-08-26	X	265613	LIGHTING POLES AND STANDARDS
2026-08-26	X	265619	EXTERIOR LIGHTING

DIVISION 27 — COMMUNICATIONS

2026-08-26	X	270000	COMMON GENERAL CONDITIONS FOR COMMUNICATIONS SECTIONS VER 01-2025
2026-08-26	X	270100	OPERATION+MAINTENANCE OF COMMUNICATION SYSTEMS VER 01-2025
2026-08-26	X	270113	WARRANTY PRODUCT AND SYSTEM VER 01-2025
2026-08-26	X	270119	FIELD TESTING AND REPORTING VER 01-2025
2026-08-26	X	270133	SHOP DRAWINGS PRODUCT DATA SAMPLES DESIGN RECORDS AND EXISTING CONDITIONS VER 01-2025
2026-08-26	X	270143	QUALIFICATIONS AND REQUIRED TRAINING FOR CONTRACTOR AND INSTALLER VER 01-2025
2026-08-26	X	270171	RESPONSIBILITY AND WORKMANSHIP OF CONTRACTOR VER 01-2025
2026-08-26	X	270500	COMMON WORK RESULTS FOR COMMUNICATIONS VER 01-2025
2026-08-26	X	270526	GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS VER 01-2025
2026-08-26	X	270528	PATHWAYS FOR COMMUNICATIONS SYSTEMS VER 01-2025
2026-08-26	X	270529	HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS VER 01-2025
2026-08-26	X	270533	CONDUITS AND BACK BOXES FOR COMMUNICATIONS SYSTEMS VER 01-2025
2026-08-26	X	270536	CABLE TRAY FOR COMMUNICATIONS SYSTEMS VER 01-2025
2026-08-26	X	270543.46	CAMPUS CABLE ROUTING VER 01-2025

2026-08-26	X	270553	IDENTIFICATION FOR LOW-VOLTAGE CABLES AND LABELING VER 01-2025
2026-08-26	X	271100	EQUIPMENT ROOM FITTING
2026-08-26	X	271116	CABINETS, RACKS, FRAMES, AND ENCLOSURES VER 01-2025
2026-08-26	X	271119	TERMINATION BLOCKS AND PATCH PANELS VER 01-2025
2026-08-26	X	271300	BACKBONE CABLING VER 01-2025
2026-08-26	X	271500	HORIZONTAL CABLING VER 01-2025
2026-08-26	X	271513	COPPER CABLE VER 01-2025
2026-08-26	X	271543	FACEPLATES AND CONNECTORS VER 01-2025 - R
2026-08-26	X	271619	PATCH CABLES VER 01-2025
2026-08-26	X	274133	MASTER ANTENNA TELEVISION SYSTEM
2026-08-26	X	275113	OHPAGE VER 01-2025
2026-08-26	X	275117	NETWORKED PA (VOCIA S-2026)
2026-08-26	X	275119	SOUND MASKING SYSTEMS (S-2026)
2026-08-26	X	275223	NURSE CALL CODE BLUE SYSTEMS
2026-08-26	X	275319	DAS - INTERNAL CELLULAR PAGING AND ANTENNA SYSTEMS VER 01-2025
2026-08-26	X	276001	APPENDIX 01 DEVIATION REQUEST PROCESS VER 01-2025
2026-08-26	X	276002	APPENDIX 02 DOCUMENT REFRESH PROCESS VER 01-2025
2026-08-26	X	276003	APPENDIX 03 DATA CENTER, TEC, TDR PART NUMBERS
2026-08-26	X	276004	APPENDIX 04 REFERENCE STANDARDS VER 01-2025
2026-08-26	X	276005	APPENDIX 05 DEFINITIONS AND ABBREVIATIONS VER 01-2025
2026-08-26	X	276006	APPENDIX 06 MATERIAL SUPPLIERS VER 01-2025
2026-08-26	X	276007	APPENDIX 07 SIEMON - CERTIFIED INSTALLATION FIRMS VER 01-2025
2026-08-26	X	276008	APPENDIX 08 LEAD WALL PENETRATIONS

DIVISION 28 — ELECTRONIC SAFETY AND SECURITY

2026-08-26	X	281300	ACCESS CONTROL (VER 01-2026)
2026-08-26	X	282300	VIDEO SURVEILLANCE (VWE 01-2026)
2026-08-26	X	282400	DIGITAL ADDRESSABLE FIRE-ALARM SYSTEM

DIVISION 31 — EARTHWORK

2026-08-26	X	310700	GENERAL SITE CONSTRUCTION REQUIREMENTS
2026-08-26	X	311000	SITE CLEARING
2026-08-26	X	312000	EARTH MOVING
2026-08-26	X	313116	TERMITE CONTROL
2026-08-26	X	315000	EXCAVATION SUPPORT AND PROTECTION

DIVISION 32 — EXTERIOR IMPROVEMENTS

2026-08-26	X	320118	TYPE II ASPHALT PATCH
2026-08-26	X	321205	HOT MIX ASPHALT PAVEMENT
2026-08-26	X	321313	CONCRETE PAVING
2026-08-26	X	321373	CONCRETE PAVING JOINT SEALANTS
2026-08-26	X	321715	PARKING ACCESSORIES
2026-08-26	X	321813	SYNTHETIC GRASS PLAYING FIELD TURF
2026-08-26	X	321826	SYNTHETIC GRASS TURF
2026-08-26	X	323113	CHAIN LINK FENCING
2026-08-26	X	323115	TUBULAR STEEL FENCING
2026-08-26	X	323117	GATE OPERATORS
2026-08-26	X	328400	IRRIGATION SYSTEM
2026-08-26	X	329000	GENERAL PLANTING REQUIREMENTS
2026-08-26	X	329113	SOIL PREPARATION
2026-08-26	X	329116	MULCHING
2026-08-26	X	329119	TOPSOIL

DIVISION 33 — UTILITIES

2026-08-26	X	330500	COMMON WORK RESULTS FOR UTILITIES
2026-08-26	X	333100	SANITARY SEWERAGE PIPING
2026-08-26	X	334100	STORM UTILITY DRAINAGE PIPING

DIVISION 34 — TRANSPORTATION

NOT USED

DIVISION 35 — WATERWAYS AND MARINE CONSTRUCTION

NOT USED

DIVISION 40 — PROCESS INTERCONNECTIONS

NOT USED

DIVISION 41 — MATERIAL PROCESSING AND HANDLING EQUIPMENT

NOT USED

DIVISION 42 — PROCESS HEATING, COOLING, AND DRYING EQUIPMENT

NOT USED

DIVISION 43 — PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT

NOT USED

DIVISION 44 — POLLUTION CONTROL EQUIPMENT

NOT USED

DIVISION 45 — INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

NOT USED

DIVISION 46 — WATER AND WASTEWATER EQUIPMENT

NOT USED

DIVISION 48 — ELECTRICAL POWER GENERATION

NOT USED

END TABLE OF CONTENTS

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 003100
AVAILABLE PROJECT INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section references other information relevant to the construction of this Project that is available project information.

B. At the request of the Owner, the information identified below represents services that have been provided by others, not as an Architect's Consultant, regarding conditions that affect this Project that are beyond the responsibilities of the Architect and Architect's Consultants. Reference to such information herein is solely for the convenience of the Owner. Architect makes no representation, express or implied, as to the accuracy or validity of the information.

C. Bidders are expected to examine the site and the information available from the Owner to determine for themselves the conditions to be encountered.

D. If conditions other than those indicated in the information available from the Owner are encountered before or during construction, notify the Owner before work continues.

1.2 PROPERTY SURVEY

A. The Owner's Surveyor has performed a property survey and the some of the survey information is included on the Drawings for the convenience of the Contractor. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

B. Copies of the documents are available from the Owner.

C. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

D. The Owner retained the following company:

1.3 GEOTECHNICAL REPORT

A. The Owner's Geotechnical Consultant has made subsurface borings at the Project site, has performed an investigation of the geotechnical conditions, and has prepared a report of the investigation that contains specific requirements of the Contractor. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

B. The information was obtained for use in preparing the foundation design but is indicative only of the soil conditions where the borings are taken.

C. Copies of the documents are available from the Owner.

D. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

E. The Owner retained the following company:

1.4 INFECTION CONTROL RISK ASSESSMENT REPORT

A. The Owner's Risk Assessment Consultant has assessed the environmental impact of the work on the existing, adjacent healthcare functions, and has prepared an Infection Control Risk Assessment (ICRA) report that includes specific requirements of the Contractor. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

B. The ICRA establishes strategic infection control provisions and requirements for the purpose of controlling the dissemination of airborne micro-organism contaminants encountered or generated during the construction process through the use of containment protocols and environmental monitoring.

C. Copies of the documents are available from the Owner.

D. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

E. The Owner retained the following company:

1.5 EXISTING CONDITIONS REPORT

A. The following existing conditions that will affect or influence the construction of this Project include the following:

1.6 CIVIL CONSTRUCTION DOCUMENTS

A. The Owner's Civil Engineering Consultant has developed civil designs for the Owner's property and has prepared construction documents. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

B. Copies of the documents are available from the Owner.

C. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

D. The Owner retained the following company:

1.7 LANDSCAPING CONSTRUCTION DOCUMENTS

A. The Owner's Landscape Architect Consultant has developed landscaping designs for the Owner's property and has prepared construction documents. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

B. Copies of the documents are available from the Owner.

C. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

D. The Owner retained the following company:

1.8 MEDICAL EQUIPMENT DOCUMENTS

A. The Owner's Medical Equipment Planning Consultant has developed medical equipment documents for the Owner's facility and has prepared construction documents. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

B. Copies of the documents are available from the Owner.

C. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

D. The Owner retained the following company:

1.9 DEMOLITION CONTRACT DOCUMENTS

A. The Owner's Demolition Consultant has determined demolition provisions for the Owner's existing property and has prepared documents indicating demolition requirements. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

B. Copies of the documents are available from the Owner.

C. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

D. The Owner retained the following company:

1.10 WIND TUNNEL TEST REPORT

A. The Owner's Wind Investigation Consultant has conducted wind tunnel testing of the building design and has prepared a report. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

B. Copies of the documents are available from the Owner.

C. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

D. The Owner retained the following company:

1.11 AVIATION AIRSPACE REQUIREMENTS

A. The Federal Aviation Agency has assessed the impact of the Work on the existing, adjacent facilities and areas, and has prepared a report that includes specific requirements of the Contractor. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

1. Report No.

B. Copies of the documents are available from the Owner.

C. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

1.12 RADIATION PROTECTION REPORT

A. The Owner's Radiation Protection Consultant has determined the radiation protection that is required, and has prepared a report that contains specific requirements of the Contractor. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

B. Copies of the documents are available from the Owner.

C. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

D. The Owner retained the following company:

1.13 ENVIRONMENTAL STUDY AND ASSESSMENT REPORT

A. The Owner's Environmental Consultant has assessed the impact on the surrounding environment, and has prepared a report that contains specific requirements of the Contractor. These Documents and attachments are not part of the Contract Documents prepared by the Architect.

B. Copies of the documents are available from the Owner.

C. Copies of the documents are included in the Contract Documents prepared by the Architect for the convenience of the Owner.

D. The Owner retained the following company:

1.14 TAX EXEMPTION STATUS INFORMATION

A. This Project qualifies for exemption from taxes as indicated in the letter following this Section.

1. Letter from , dated .

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 005200

AGREEMENT FORM

PART 1 - GENERAL

1.1 GENERAL

A. The Form of Agreement Between Owner and Contractor where the basis for payment is a STIPULATED SUM will be the form used as a Contract for this Project.

B. The Form of Agreement Between Owner and Contractor where the basis for payment is the COST OF THE WORK PLUS A FEE with a negotiated Guaranteed Maximum Price will be the form used as a Contract for this Project.

C. A copy of the Document is available from the Owner.

D. A copy of the Document is included in this Project Manual.

PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 007200
GENERAL CONDITIONS

PART 1 - GENERAL

1.1 GENERAL

A. The General Conditions of this Contract are available from the Owner, hereinafter referred to as the "General Conditions."

B. The General Conditions of this Contract are are referenced in the Owner-Contractor Agreement, hereinafter referred to as the "General Conditions."

C. The General Conditions shall apply to each, and every Section of the Work as though written in full therein and are part of the Contract Documents.

D. A copy of the General Conditions is included in this Project Manual. The General Conditions shall apply to each, and every Section of the Work as though written in full therein and are part of the Contract Documents.

PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 007300
SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.1 GENERAL

A. The Supplementary Conditions modify, change, delete from or add to the General Conditions and shall apply to each, and every Section of the Work as written in full therein.

B. The following paragraphs and subparagraphs take precedence over the General Conditions. Where any part of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered provisions remain in effect.

C. Correlation and Intent of the Contract Documents:

1. Sections of Division 01 - General Requirements govern the execution of all sections of the specifications.
2. Summary paragraphs placed at the beginning of the Sections present a brief indication of the principal Work included in that Section, but do not limit Work to subject mentioned nor purport to itemize Work that may be included.
3. The Relation of Specifications, Drawings, and Model for those model elements included in the scope of “digital delivery” shall be equal authority and priority. Should they disagree in themselves, or with each other, bids shall be based on the most expensive combination of quality and quantity of work indicated. The appropriate Work, in the event of the above mentioned disagreements, shall be determined by the Architect.
4. Should the Drawings and Models disagree themselves, figures shall govern over scaled measurements, large scale Drawings or Model elements shall govern over small scale Drawings or Model elements, and the greater quantity of work or materials shall be furnished or performed. Descriptive writings shall govern over both Drawing and Model legends and schedules indicating material or conditions. The Agreement takes precedence over all other Contract Documents.
5. Should there be a conflict in Contract Documents, the Contractor shall proceed in the more expensive manner unless determined otherwise by the Architect.
6. Instructions, directions and requirements as specified shall be considered to be followed by the phrase "unless otherwise specified or indicated".

1.2 INTERPRETATION

A. In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.3 INFORMATIONAL SUBMITTALS

A. Informational Submittals: Informational submittals may be identified as such in the Contract Documents.

1.4 PROFESSIONAL CERTIFICATION

A. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 010510
EXTERIOR DESIGN SELECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes a schedule summary of Design Selections for materials and finishes technically specified in various technical Sections of this Project Manual.

1.2 PROCEDURES

A. References in this Section to specific manufacturer, model name and model number, are to establish preferred design selection standard only. Other "Acceptable Manufacturers" listed in the technical section, if qualified, are allowed to submit in accordance with Division 01 Section "Product Requirements".

B. Each material selection is referenced by Section name and number to where it is specified.

PART 2 - PRODUCTS

2.1 GENERAL SELECTIONS

A. Following materials may be included in a number of technical specification sections and are scheduled together to avoid duplication.

B. STONES - EXTERIOR

1. ST01:

a. Stone Type: [Granite][Marble][Limestone][Slate]
b. Supplier/Quarry:
c. Stone Name:
d. Finish Selection: [Polished][Honed][Flame/Thermal]
e. Grout/Sealant Color:

C. EXTERIOR ARCHITECTURAL METAL FINISH

1. AMF01:

a. Material Type: Aluminum
b. Finish Type: [Anodized][High-Performance Organic Fluoropolymer].
c. Finish Type: [Baked Enamel or Powder–ÓCoat].
d. Anodized Color: [Clear][Champagne][Light bronze][Medium bronze][Dark bronze][Black]
e. Coating Color:

2. AMF02:

a. Material Type: Steel
b. Finish Type: [High-Performance Organic Fluoropolymer]
c. Finish Type: [Baked-Enamel][Powder-Coat][Siliconized-Polyester]
d. Coating Color:

3. AMF03:

a. Material Type: Stainless Steel
b. Mechanical Polish: [Bright, Cold-Rolled, Unpolished Finish: No. 2B][Directional Satin Finish: No. 4][Dull Satin Finish: No. 6][Satin, Reflective, Directional Polish: No. 7][Mirrorlike Reflective, Nondirectional Polish: No. 8 finish].

4. AMF04:

    a. Material Type: Copper Alloy
    b. Finish Type: [Buffed Finish][Hand-Rubbed Finish][Medium-Satin Finish][Fine-Matte Finish]
    c. [Buffed Finish, Lacquered][Hand-Rubbed Finish, Lacquered][Medium-Satin Finish, Lacquered][Fine-Matte Finish, Lacquered][Statuary Conversion Coating over Satin Finish, Lacquered]

        1) Coating: Clear, Organic Coating

    d. Statuary Conversion Coating over Satin Finish

2.2 DIVISION 3 SELECTIONS BY SECTION

A. 033500 - Concrete Finishing

1. Sealed Concrete (SC): Penetrating liquid floor hardener; refer back to technical section for requirements.
2. SC01: Penetrating Liquid Floor Hardener and Sealer
3. SC02: Curing and Sealing Compound
4. CF01: Special Concrete Finish

    a. Dry Shake Floor Hardener Finish Color:
    b. Color Additive:
    c. Stain Color:
    d. Imprinting Pattern:
    e. Polished Concrete Finish with Penetrating Liquid Floor Treatment

B. 034500 - Architectural Precast Concrete

1. PC01:

    a. Exposed Aggregate:
    b. Sandblast: [Light] [Medium] [Heavy]
    c. Color Additive:
    d. Cement Color:

2. PC02:

    a. Stone Facing: ST XX See Stone Schedule above
    b. Cement Color:

3. PC03 - Thin Masonry Units:

    a. Manufacturer:
    b. Masonry Type
    c. Product Series:
    d. Color Name and Number:
    e. Face Style:
    f. Color Selection:
    g. Face Size:

C. 034900 - Glass-Fiber-Reinforced Precast Concrete (GFRC)

1. GFRC01:

    a. Finish: [Exposed Aggregate][As-Cast-Surface Finish][Textured-Surface Finish][Bushhammer Finish][Retarded Finish][Sand- or Abrasive-Blast Finish][Acid-Etched Finish][Honed Finish][Polished Finish][Match Sample]
    b. Cement Color: [Gray] [White] [Tan]

c. Color Additive:

2.3 DIVISION 4 SELECTIONS BY SECTION

A. 042100 - Masonry Veneer

1. MV01:

a. Manufacturer:
b. Product Series:
c. Color Name and Number:
d. Face Style or Texture:
e. Color Selection:
f. Size (Actual Dimensions): " thick, " wide, " long
g. Mortar Color:
h. Bond Pattern:

B. 042200 - Concrete Unit Masonry

1. CMU01:

a. Manufacturer:
b. Product Series:
c. Color Name and Number:
d. Face Texture: [Ground Face][Split-Face][Scored Face]
e. Size (Actual Dimensions): Width: 7-5/8 in (190 mm), Height: 7-5/8 in (190 mm), Length: 15-5/8 in (390 mm).
f. Mortar Color:
g. Bond Pattern: One-Half Running Bond.

C. 042300 - Glass Unit Masonry

1. GMU01:

a. Manufacturer:
b. Model / Pattern:
c. Glass Color:
d. Edge-Coating Color: White.
e. Unit Sizes: 7-3/4 in (194 mm) square by 3-7/8 in (96 mm) thick.
f. Corner Unit and End Units: Manufacturer's standard units.
g. Mortar Color:

D. 044200 - Exterior Stone Cladding

1. Stone: STXX; See Stone schedule above.
2. Sealant Color: Match stone color

E. 047200 - Cast Stone Masonry

1. CSM01:

a. Color:
b. Aggregate:
c. Exposed Texture Finish: [Smooth][Honed][Sand Texture]

F. 047500 - Adhered Masonry Veneer

1. AMV01:

a. Manufacturer:
b. Product Series:

c. Color Name and Number:
d. Face Style:
e. Size (Actual Dimensions):

1) Width:
2) Height:
3) Length:
4) Vertical Coursing:

2.4 DIVISION 5 SELECTIONS BY SECTION

A. 055813 - Ornamental Metal Column Covers

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

B. 057300 - Ornamental Handrails and Railings

1. Metal Railing:

a. Material:
b. Finish:
c. Material / Finish: AMFXX; See Architectural Metal Finishes above

2. Glass Railing:

a. Top Rail Material:
b. Finish:
c. Top Rail Material / Finish: AMFXX; See Architectural Metal Finishes above
d. Glass Type: GLXX

3. OHR01 - Metal Railing:

a. Material:
b. Finish:
c. Material / Finish: AMFXX; See Architectural Metal Finishes above

4. OHR02 - Glass Handrails:

a. Top Rail Material / Finish:
b. Top Rail Material / Finish: AMFXX; See Architectural Metal Finishes above
c. Glass Type: GLXX

2.5 DIVISION 7 SELECTIONS BY SECTION

A. 071800 - Traffic Coatings

1. TC01:

a. Type:
b. Color: [As selected from manufacturer's standard][As selected from manufacturer's custom colors][Special Custom Color]

B. 072400 - EIFS

1. EIFS01:

a. Manufacturer:
b. Texture:
c. Color:
d. Sealant Color:

C. 072423 - DEFS For Soffits

1. DEFS01:

    a. Manufacturer:
    b. Texture:
    c. Color:
    d. Sealant Color:

D. 073113 - Asphalt Shingles

1. Manufacturer:
2. Style:
3. Texture:
4. Color:

E. 073200 - Roof Tiles

1. CRT01:

    a. Manufacturer:
    b. Style:
    c. Color:

F. 074114 - Metal Roof Panels

1. Finish Color: AMFXX; See Architectural Metal Finishes above

G. 074213 - Formed Metal Wall Panels

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

H. 074243 - Composite Metal Wall Panels

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

I. 074263 - Insulated-Core Metal Wall Panels

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

J. 076200 - Flashing and Sheet Metal

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

K. 077600 - Roof Pavers and Pedestal Assemblies

1. Paver Manufacturer:
2. Size:
3. Color:
4. Finish:

L. 07 9200 - Joint Sealants

1. Silicone Construction Sealant:

    a. Color Selection: Special Custom Color as selected
    b. Color Selection: As selected from Manufacturer's Custom Colors
    c. Color Selection: As selected from Manufacturer's Standard Colors

2. Silicone Mildew Resistant Sealant:

    a. Color Selection: [White][Transparent]
    b. Color Selection: As selected from Manufacturer's Standard Colors

2.6 DIVISION 8 SELECTIONS BY SECTION

A. 083213 - Sliding Aluminum-Framed Glass Doors

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

B. 083323 - Overhead Coiling Doors

1. Material / Finish Color: AMFXX; See Architectural Metal Finishes above
2. Material: [Aluminum][Steel][Stainless Steel]
3. Finish: [Mill][Anodized][Baked Enamel or Powder-Coat][No. 4 satin][No. 2b]
4. Color:

C. 083326 - Overhead Coiling Grilles

1. Material / Finish Color: AMFXX; See Architectural Metal Finishes above
2. Material: [Aluminum][Steel][Stainless Steel]
3. Finish: [Mill][Anodized][Baked Enamel or Powder-Coat][No. 4 satin][No. 2b]
4. Color:

D. 083613 - Sectional Overhead Doors

1. Material: [Aluminum][Steel]
2. Finish: [Mill][Anodized][Organic][Powder Coat][Field Painted]
3. Color:

E. 084213 - Exterior Aluminum Entrance Doors

1. Finish Color: AMFXX; See Architectural Metal Finishes above.
2. Hardware Finish Selection: Match interior door hardware.

F. 084226 - All-Glass Entrances

1. Finish Color: AMFXX; See Architectural Metal Finishes above.
2. Hardware Finish Selection: Match door finish.

G. 084229 - Automatic Entrances

1. Sliding Doors

   a. Finish Color: AMFXX; See Architectural Metal Finishes above.

2. Swinging Doors

   a. Finish Color: AMFXX; See Architectural Metal Finishes above.

3. Folding Doors

   a. Finish Color: AMFXX; See Architectural Metal Finishes above.

H. 084233 - Revolving Entrance Doors

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

I. 084400 - Glazed Aluminum Framing Systems

1. Finish Color: AMFXX; See Architectural Metal Finishes above.
2. Exterior Aluminum Entrance Doors

   a. Finish Color: AMFXX; See Architectural Metal Finishes above.
   b. Hardware Finish Selection: Match interior door hardware.

J. 084426 - Structural Glass Curtain Walls

1. Finish Color Selection: AMFXX; See Architectural Metal Finishes above.

K. 084433 - Sloped Glazing Assemblies

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

L. 085113 - Aluminum Windows

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

M. 085619 –Ó Sliding Pass Windows

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

N. 086200 - Unit Skylights

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

O. 086300 - Metal-Framed Skylights

1. Finish Color Selection: AMFXX; See Architectural Metal Finishes above.

P. 087100 - Door Hardware

1. Locksets/Latchsets:

a. Manufacturer:
b. Series Selection:
c. Trim Assembly Style Selection:

1) Lever: #
2) Rose/Escutcheon: #

d. Finish: US 32D Satin Stainless Steel

Q. 088000 - Glazing

1. NOTE: Where glass thickness is indicated, it is a minimum for detailing purposes. Provide glass lites in thicknesses as needed to comply with applicable requirements.
2. Exterior Glass Schedule: (Note: Provide FT glass where required for safety glazing.)

a. GL01: Insulating Coated Glass - Vision

1) Overall Thickness: 1 in (25 mm) nominal.
2) Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
3) Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
4) Air Space: 1/2 in (12 mm); [Aluminum][Stainless Steel], [Mill Finish][Black], [Air][Argon].
5) Inboard Lite: Clear HS; 1/4 in (6 mm) thick glass.
6) Basis of Design Manufacturer and Product:
7) Performance Requirements:

a) Visible Light Transmittance:
b) Exterior (Vis-Out) Reflectance:
c) Winter U-Value:
d) Summer U-Value:
e) Shading Coefficient:
f) Solar Heat Gain Coefficient:
g) Light to Solar Gain Ratio:

b. GL02: Insulating Coated Glass, Ceramic-Coated - Vision

1) Overall Thickness: 1 in (25 mm) nominal.

2) Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.

a) Silk-Screened Ceramic Frit: [Color][Pattern; eg: Pattern of alternating 10 mm horizontal color bands and 10 mm open bands starting at the top with a line on No. 2 surface].

b) Digital Image Ceramic Ink: Custom digital image applied to glass and heat-fused to glass.

3) Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
4) Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
5) Inboard Lite: Clear HS; 1/4 in (6 mm) thick glass.
6) Basis of Design Manufacturer and Product:

c. GL03: Insulating Coated Glass –ÓÓ Vision with Back Panel

1) Overall Thickness: 1 in (25 mm) nominal.
2) Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
3) Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
4) Inboard Lite: Clear HS; 1/4 in (6 mm) thick glass.
5) Back Panel: Aluminum, 2 mm thick with prefinished color: [List Color]
6) Basis of Design Manufacturer and Product:

d. GL04: Insulating Glass –ÓÓ Vision at Lobby (Low Iron)

1) Overall Thickness: 1 in (25 mm) nominal.
2) Outboard Lite: Clear, Low Iron FT; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
3) Air Space: 1/2 in (12 mm); Grey spacer; Grey sealant.
4) Inboard Lite: Clear, Low Iron FT; 1/4 in (6 mm) thick glass.
5) Basis of Design Manufacturer and Product:
6) Remarks: Sealants and Gaskets to be Grey color unless indicated otherwise.

e. GL05: Insulating Laminated Coated Glass –Ó Vision [Hurricane Resistant, Large Missile Impact][Hurricane-Resistant, Small Missile Impact][Blast-Resistant][Skylight]

1) Overall Thickness: As required by design.
2) Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
3) Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
4) Inboard Lite: Two plies Clear HS; 1/4 in (6 mm) thick glass; laminated.
5) Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in (2.50 mm)].
6) Basis of Design Manufacturer and Product:

f. GL06: Laminated Insulating Coated Glass –Ó Vision [Hurricane Resistant][Blast-Resistant][Skylight]

1) Overall Thickness: As required by design.
2) Outboard Lite: Two plies Clear HS; 1/4 in (6 mm) thick glass; laminated.
3) Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in (2.50 mm)].

4) Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
5) Inboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 4 surface.
6) Basis of Design Manufacturer and Product:

g. GL07: Insulating Laminated Coated Glass –Ó Acoustical Vision

1) Overall Thickness: 1.5 in. (38mm), STC 45.
2) Outboard Lite: Two plies Clear HS; 1/4 in (6 mm) thick glass; laminated with coating on No. 2 surface. Interlayer: 0.60 in PVB.
3) Air Space: 3/4 in (19 mm); Black spacer; Black sealant.
4) Inboard Lite: Two plies Clear HS; 1/8 in (3 mm) thick glass; laminated.
5) Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in (2.50 mm)].
6) Basis of Design Manufacturer and Product:

h. GL08: Laminated Coated Glass –Ó Vision

1) Overall Thickness: As required by design.
2) Outboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass with coating on No. 2 surface.
3) Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
4) Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).] [.100 in (2.50 mm)].
5) Basis of Design Manufacturer and Product:

i. GL09: Laminated Glass –ÓÓ Vision

1) Overall Thickness: As required by design.
2) Outboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
3) Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
4) Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).] [.100 in (2.50 mm)].
5) Basis of Design Manufacturer and Product:

j. GL10: Laminated Glass, Ceramic-Coated –ÓÓ Canopy

1) Overall Thickness: As required by design.
2) Upper Lite: Clear HS; 3/8 in (10 mm) minimum thick glass with ceramic frit on the No. 2 surface.

a) Silk-Screened Ceramic Frit: [Color][Pattern; eg: Pattern of alternating 10 mm horizontal color bands and 10 mm open bands starting at the top with a line on No. 2 surface].
b) Digital Image Ceramic Ink: Custom digital image applied to glass and heat-fused to glass.

3) Lower Lite: Clear HS; 3/8 in (10 mm) minimum thick glass.
4) Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).] [.100 in (2.50 mm)].
5) Basis of Design Manufacturer and Product:

k. GL11: Laminated Glass, Ceramic-Coated –Ó Guardrail

1) Overall Thickness: As required by design.

2) Outboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass with ceramic frit.

a) Silk-Screened Ceramic Frit: [Color][Pattern; eg: Pattern of alternating 10 mm horizontal color bands and 10 mm open bands starting at the top with a line on No. 2 surface].
b) Digital Image Ceramic Ink: Custom digital image applied to glass and heat-fused to glass.

3) Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
4) Interlayer –Ó Basis of Design: Dupont SentryGlas “ÓIonoplast”□; Clear, thickness as required for intended use.
5) Basis of Design Manufacturer and Product:

l. GL12: Laminated Glass –Ó Guardrail

1) Overall Thickness: As required by design.
2) Outboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
3) Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
4) Interlayer –ÓÓ Basis of Design: Dupont SentryGlas “ÓÓIonoplast”□□; Clear, thickness as required for intended use.
5) Basis of Design Manufacturer and Product:

m. GL13: Monolithic Coated Glass

1) Overall Thickness: 1/4 in (6 mm) nominal.
2) Monolithic Lite: Clear; 1/4 in (6 mm)) thick glass with coating on No. 2 surface.
3) Basis of Design Manufacturer and Product:

n. GL14: Monolithic Glass –Ó All Glass Doors and Vestibules

1) Lite: Clear FT; 5/8 in (15 mm) minimum thick glass.

o. GL15: Insulating Coated Glass, Ceramic-Coated - Spandrel

1) Overall Thickness: 1 in (25 mm) nominal.
2) Outboard Lite: Clear; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
3) Air Space: 1/2 in (12 mm); Black sealant.
4) Inboard Lite: Clear; 1/4 in (6 mm) thick glass with ceramic frit on No. 4 surface.

a) Silk-Screened Ceramic Frit: [Color].
b) Digital Image Ceramic Ink: Custom digital image applied to glass and heat-fused to glass.

5) Basis of Design Manufacturer and Product:

p. GL16: Insulating Laminated Coated Glass –Ó Spandrel [Hurricane Resistant][Blast-Resistant][Skylight]

1) Overall Thickness: As required by design.
2) Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
3) Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
4) Inboard Lite: Two plies Clear HS; 1/4 in (6 mm) thick glass; laminated.
5) Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).] [.100 in (2.50 mm)].

6) Basis of Design Manufacturer and Product:

q. GL17: Monolithic Glass - Spandrel

1) Overall Thickness: 1/4 in (6 mm) nominal.
2) Monolithic Lite: Clear; 1/4 in (6 mm)) thick glass with [Color] ceramic frit on No. 2 surface.
3) Basis of Design Manufacturer and Product:

R. 089100 - Wall Louvers

1. Finish Color: AMFXX See Architectural Metal Finishes above.

2.7 DIVISION 9 SELECTIONS BY SECTION

A. 092400 - Portland Cement Plastering

1. PCP01:

a. Texture: [Sand Float] [Smooth Trowel][Puddy Trowel]

B. 099100 - Painting

1. Exterior Paint Colors:

a. PT01:

1) Manufacturer:
2) Number:
3) Sheen:
4) Texture:
5) Color:
6) Type:

C. 099600 - High Performance Coatings

1. HPC01:

a. Manufacturer:
b. Number:
c. Sheen:
d. Texture:
e. Color:

D. 099653 - Elastomeric Coatings

1. EC01:

a. Manufacturer:
b. Texture: [Smooth][Fine][Coarse]
c. Color:

E. 099663 - Textured Acrylic Coating

1. TAC01:

a. Manufacturer:
b. Texture: [Smooth][Fine][Coarse]
c. Color:

2.8 DIVISION 12 SELECTIONS BY SECTION

A. 124816 - Entrance Foot Grilles

1. FG01:

    a. Material Type: Aluminum
    b. Finish Type: Anodized
    c. Anodized Color: [Clear][Champagne][Light bronze][Medium bronze][Dark bronze][Black]

2. FG02:

    a. Material Type: Stainless Steel
    b. Finish: [Mill][Directional Satin Finish: No. 4]

B. 124843 - Floors Mats

1. FM01:

    a. Aluminum Finish: Anodized

        1) Color: [Clear][Bronze][Black]

    b. Carpet Inserts:
    c. Vinyl Inserts:

2.9 DIVISION 32 SELECTIONS BY SECTION

A. 321313 - Concrete Paving

1. Exposed Aggregate:
2. Cement Color:
3. Dry-Shake Color:
4. Color Additive:
5. Stain Color:

B. 321413 - Interlocking Precast Concrete Paving

1. ICP01:

    a. Manufacturer:
    b. Size:
    c. Color:
    d. Texture:
    e. Pattern:

C. 321416 - Brick Unit Paving

1. BP01:

    a. Manufacturer:
    b. Size:
    c. Color:
    d. Texture:
    e. Pattern:
    f. Mortar Color:

D. 321440 - Stone Paving

1. STP01:

    a. Stone Type:
    b. Supplied/Quarry:
    c. Stone Name:
    d. Finish:

e. Grout Color:
f. Stone: STXX; See Stone scheduled above
g. Grout Color:

PART 3 - EXECUTION - Not Used

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 010520
INTERIOR DESIGN SELECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes a schedule summary of Design Selections for materials and finishes technically specified in various technical Sections of this Project Manual.

1.2 PROCEDURES

A. References in this Section to specific manufacturer, model name and model number, are to establish preferred design selection standard only. Other "Acceptable Manufacturers" listed in the technical section, if qualified, are allowed to submit in accordance with Division 01 Section "Product Requirements".

B. Each material selection is referenced by Section name and number to where it is specified.

PART 2 - PRODUCTS

2.1 GENERAL SELECTIONS

A. Following materials may be included in a number of technical specification sections and are scheduled together to avoid duplication.

B. STONES - INTERIOR

1. ST101:

a. Stone Type: [Granite][Marble][Limestone][Slate]
b. Supplier/Quarry:
c. Stone Name:
d. Finish Selection: [Polished][Honed][Flame/Thermal]
e. Grout/Sealant Color:

C. INTERIOR ARCHITECTURAL METAL FINISH

1. AMF101:

a. Material Type: Aluminum
b. Finish Type: [Mechanical][Anodized][High Performance Organic Fluorpolymer][Baked Enamel or Powder-Coat]
c. Anodized Color: [Clear][Champagne][Light bronze][Medium bronze][Dark bronze][Black]
d. Coating Color:

2. AMF102:

a. Material Type: Steel
b. Finish Type: [High Performance Organic Fluorpolymer][Baked-Enamel][Powder-Coat][Siliconized-Polyester]
c. Coating Color:
d. Finish Type: Specialty Coating on Hot-Rolled Steel.
e. Coating:

1) Match Architects Sample.
2) Basis of Design: Specified Specialty Products; "Mainstreet, SIM #105".

3. AMF103:

a. Material Type: Stainless Steel
b. Mechanical Polish: [Bright, Cold-Rolled, Unpolished Finish: No. 2B][Directional Satin Finish: No. 4][Dull Satin Finish: No. 6][Satin, Reflective, Directional Polish: No. 7][Mirrorlike Reflective, Nondirectional Polish: No. 8 finish].

4. AMF104:

a. Material Type: Copper Alloy
b. Finish Type: [Buffed Finish][Hand-Rubbed Finish][Medium-Satin Finish][Fine-Matte Finish]
c. [Buffed Finish, Lacquered][Hand-Rubbed Finish, Lacquered][Medium-Satin Finish, Lacquered][Fine-Matte Finish, Lacquered][Statuary Conversion Coating over Satin Finish, Lacquered]

1) Coating: Clear, Organic Coating

d. Statuary Conversion Coating over Satin Finish

D. HIGH-PRESSURE DECORATIVE LAMINATES (HPDL)

1. PL01:

a. Manufacturer:
b. Texture:
c. Color:

E. CHEMICAL-RESISTANT HIGH-PRESSURE DECORATIVE LAMINATE (HPDL)

1. CRPL01:

a. Manufacturer:
b. Texture:
c. Color:

F. WOODS

1. WD01:

a. Species and Cut:
b. Stain:

G. SIMULATED STONE FABRICATIONS

1. SSF01:

a. Type: [Solid Surfacing][Quartz Agglomerate][Cultured Marble]
b. Manufacturer:
c. Product:

2.2 DIVISION 3 SELECTIONS BY SECTION

A. 033500 - Concrete Finishing

1. Sealed Concrete (SC): Penetrating liquid floor hardener; refer back to technical section for requirements.
2. SC01: Penetrating Liquid Floor Hardener and Sealer
3. SC02: Curing and Sealing Compound
4. CF01: Special Concrete Finish

a. Dry Shake Floor Hardener Finish Color:
b. Color Additive:
c. Stain Color:

d. Imprinting Pattern:
e. Polished Concrete Finish with Penetrating Liquid Floor Treatment

2.3 DIVISION 4 SELECTIONS BY SECTION

A. 042300 - Glass Unit Masonry

1. GMU01:

a. Manufacturer:
b. Model / Pattern:
c. Glass Color:
d. Edge-Coating Color: White.
e. Unit Sizes: 7-3/4 in (194 mm) square by 3-7/8 in (96 mm) thick.
f. Corner Unit and End Units: Manufacturer's standard units.
g. Mortar Color:

B. 047500 - Adhered Masonry Veneer

1. AMV01:

a. Manufacturer:
b. Product Series:
c. Color Name and Number:
d. Face Style:
e. Size (Actual Dimensions):

1) Width:
2) Height:
3) Length:
4) Vertical Coursing:

2.4 DIVISION 5 SELECTIONS BY SECTION

A. 055813 - Ornamental Metal Column Covers

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

B. 057300 - Ornamental Handrails and Railings

1. Metal Railing:

a. Material:
b. Finish:
c. Material / Finish: AMFXX; See Architectural Metal Finishes above

2. Glass Railing:

a. Top Rail Material:
b. Finish:
c. Top Rail Material / Finish: AMFXX; See Architectural Metal Finishes above
d. Glass Type: GLXX

3. OHR01 - Metal Railing:

a. Material:
b. Finish:
c. Material / Finish: AMFXX; See Architectural Metal Finishes above

4. OHR02 - Glass Handrails:

a. Top Rail Material / Finish:

b. Top Rail Material / Finish: AMFXX; See Architectural Metal Finishes above
c. Glass Type: GLXX

C. 057500 - Ornamental Formed Metals

1. Material:
2. Finish:
3. Material / Finish: AMFXX; See Architectural Metal Finishes above
4. OM01:

a. Type:
b. Material:
c. Finish:
d. Material / Finish: AMFXX; See Architectural Metal Finishes above

2.5 DIVISION 6 SELECTIONS BY SECTION

A. 064023 - Interior Architectural Woodwork

1. Wood Types Schedule

a. Wood Species and Cut for Transparent Finish: WDXX; See Woods above

2. Laminate Types Schedule

a. High-Pressure Decorative Laminates (HPDL): PLXX; See Laminates above
b. Chemical-Resistant, High-Pressure Decorative Laminates (HPDL): CR/PLXX; See Laminates above

3. Simulated Stone Schedule

a. Simulated Stone Fabrication Selection: SSFXX; see Simulated Stone above.

4. Tackable Wall Surface Types Schedule

a. FP01:

1) Manufacturer:
2) Product:
3) Selection:

5. Flush Wood Paneling Matching Schedule

a. Matching of Adjacent Veneer Leaves:

1) Book match.
2) Slip match.
3) As indicated on drawings.

b. Matching within Panel Face:

1) Running match.
2) Balance match.
3) Center-balance match.
4) As indicated on drawings.

c. Panel-Matching Method: Match panels within each separate area by the following method:

1) Blueprint-matched panels and components.
2) Flitch Requirements:

d. Vertical Panel Matching Method: For panels arranged two or more panels high, match as follows:

1) Continuous end match; veneer leaves of upper panels are continuations of veneer leaves of lower panels.
2) Architectural end book match; veneer leaves are individually book matched from lower panels to upper panels.
3) Architectural end slip match; veneer leaves are individually slip matched from lower panels to upper panels.
4) Panel end book match; panels are book matched from lower panels to upper panels.
5) Panel end slip match; panels are slip matched from lower panels to upper panels.

6. Stile And Rail Wood Paneling Flitch Requirements Schedule

a. Flitch Requirements:

7. Wood Cabinets Matching Schedule

a. Matching of Veneer Leaves:

1) Book match.
2) Slip match.
3) Random match
4) As indicated on drawings.

b. Matching Within Panel Face:

1) Running match.
2) Balance match.
3) Center-balance match.
4) As indicated on drawings.

c. Veneer Matching within Room: Blueprint matching; Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

8. Shop Finishing Schedule

a. Transparent Finish:

1) AWI Finish System: Conversion varnish.
2) Staining: Match Architect's sample.
3) Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4) Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood. Apply wash-coat sealer after staining and before filling.
5) Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

b. Opaque Finish:

1) AWI Finish System: Conversion varnish.
2) Color: Match Architect's sample.
3) Color: Paint PT-XX; refer to 09 9110
4) Sheen: Semi-gloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

B. 064223 - Slatwall Paneling

1. Finish: PLXX; See Plastic Laminates above

C. 066100 - Simulated Stone Fabrications

1. Simulated Stone Fabrication Selection: SSFXX; see Simulated Stone above.

D. 066400 - Plastic (FRP) Paneling

1. FRP01:

a. Panel Color:

E. 066419 - Simulated Stone Paneling

1. Simulated Stone Fabrication Selection: SSFXX; see Simulated Stone above.

2.6 DIVISION 7 SELECTIONS BY SECTION

A. 071800 - Traffic Coatings

1. TC01:

a. Type:
b. Color: [As selected from manufacturer's standard][As selected from manufacturer's custom colors][Special Custom Color]

B. 07 9200 - Joint Sealants

1. Silicone Mildew Resistant Sealant:

a. Color Selection: [White][Transparent]
b. Color Selection: As selected from Manufacturer's Standard Colors

2.7 DIVISION 8 SELECTIONS BY SECTION

A. 081216 - Interior Aluminum Frames

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

B. 081416 - Prefinished Flush Wood Doors

1. High Pressure Decorative Laminate: PLXX; See Plastic Laminates above.
2. Wood Species and Cut: WDXX; See Woods above.

a. Transparent Factory Finish:

1) AWI conversion varnish system
2) WI System 4 clear conversion varnish system
3) Grade: Premium
4) Stain: As indicated or as selected from submitted samples.
5) Effect: [Semi-filled if open grain][Open-grain][Filled]
6) Sheen: Satin, 30-50 gloss

b. Opaque Factory Finish:

1) AWI conversion varnish.
2) WI System 4 clear conversion varnish.
3) Grade: Premium.
4) Color: As indicated or match sample accepted by Architect.
5) Sheen: Semigloss.

C. 081433 - Stile and Rail Wood Doors

1. Wood Species: WDXX; See Woods above.
    a. Transparent Factory Finish:
        1) AWI conversion varnish system
        2) WI System 4 clear conversion varnish system
        3) Grade: Premium
        4) Stain: As indicated or as selected from submitted samples.
        5) Effect: [Semi-filled if open grain][Open-grain][Filled]
        6) Sheen: Satin, 30-50 gloss
    b. Opaque Factory Finish:
        1) AWI conversion varnish.
        2) WI System 4 clear conversion varnish.
        3) Grade: Premium.
        4) Color: As indicated or match sample accepted by Architect.
        5) Sheen: Semigloss.

D. 083213 - Sliding Aluminum-Framed Glass Doors
1. Finish Color: AMFXX; See Architectural Metal Finishes above.

E. 083323 - Overhead Coiling Doors
1. Material / Finish Color: AMFXX; See Architectural Metal Finishes above
2. Material: [Aluminum][Steel][Stainless Steel]
3. Finish: [Mill][Anodized][Baked Enamel or Powder-Coat][No. 4 satin][No. 2b]
4. Color:

F. 083326 - Overhead Coiling Grilles
1. Material / Finish Color: AMFXX; See Architectural Metal Finishes above
2. Material: [Aluminum][Steel][Stainless Steel]
3. Finish: [Mill][Anodized][Baked Enamel or Powder-Coat][No. 4 satin][No. 2b]
4. Color:

G. 083513 - Folding Doors
1. Facing: [Wood veneer][Vinyl][Fabric][Carpet][Plastic Laminate]
2. Selection:

H. 083515 - Accordion Folding Fire Doors
1. Color Selections:
    a. As selected from Manufacturer's standard colors.
    b. As selected from Manufacturer's custom colors.
    c. Color:

I. 084110 - Interior Storefront
1. Finish Color: AMFXX; See Architectural Metal Finishes above.

J. 084216 - Interior Aluminum Entrance Doors
1. Finish Color: AMFXX; See Architectural Metal Finishes above.
2. Hardware Finish Selection: Match interior door hardware.

K. 084226 - All-Glass Entrances
1. Finish Color: AMFXX; See Architectural Metal Finishes above.

2. Hardware Finish Selection: Match door finish.

L. 085619 - Sliding Pass Windows

1. Finish Color: AMFXX; See Architectural Metal Finishes above.

M. 087100 - Door Hardware

1. Locksets/Latchsets:

a. Manufacturer:
b. Series Selection:
c. Trim Assembly Style Selection:

1) Lever: #
2) Rose/Escutcheon: #

d. Finish: US 32D Satin Stainless Steel

N. 088000 - Glazing

1. NOTE: Where glass thickness is indicated, it is a minimum for detailing purposes. Provide glass lites in thicknesses as needed to comply with applicable requirements.
2. Interior Glass Schedule:

a. GL101: 1/4 in (6 mm) thick clear float glass.
b. GL102: 1/4 in (6 mm) thick fully tempered clear glass.
c. GL103: 1/4 in (6 mm) thick wire glass.
d. GL104: 5/8 in (15 mm) thick fully tempered clear glass.
e. GL105: 3/4 in (19 mm) thick fully tempered clear glass
f. GL106: Laminated glass - Vision.

1) Overall Thickness: As required by design.
2) Outboard Lite: Clear float, 1/4 in (6 mm) minimum thick glass.
3) Inboard Lite: Clear float; 1/4 in (6 mm) minimum thick glass.
4) Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear,][thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).] [.100 in (2.50 mm)].

g. GL107: Patterned Glass

1) Thickness: 1/4 in (6 mm)
2) Description:
3) Mfr. and Model:

h. GL108: Bullet-Resistive Glass

1) Thickness:
2) Description:
3) Mfr. and Model:

i. GL109: Fire Rated Glass

1) Thickness:
2) Description:
3) Mfr. and Model:

j. GL110 Transparent Mirror

1) Thickness: 1/4 in (6 mm)
2) Color: [Clear][Grey]
3) Mfr. and Model: Interpane "MirroVue"

k. GL111: Decorative Glass

1) Manufacturer:
2) Pattern:

O. 088113 - Decorative Glazing

1. GL201:

a. Manufacturer:
b. Pattern:
c. Color:

2.8 DIVISION 9 SELECTIONS BY SECTION

A. 092300 - Gypsum Plastering

1. Texture: [Sand Float] [Smooth Trowel][Puddy Trowel][Acoustical]

B. 092613 - Gypsum Veneer Plastering

1. GVP01:

a. Texture: [Smooth Trowel][Textured]

C. 093000 - Tiling

1. T01:

a. Type: Ceramic Wall and Floor Tile.
b. Manufacturer / Supplier:
c. Style Name and Number:
d. Color Name and Number:
e. Size: in by in by in (mm by mm by mm) thick.
f. Pattern: As indicated on the Drawings.
g. Grout Color:

1) Manufacturer:
2) Color Name and Number:

h. Trim: Provide tile trim and accessories that match color and finish of adjoining flat tile as required to prevent unfinished edges of tile from being exposed to view.

2. T02:

a. Type: Porcelain Ceramic Wall and Floor Tile.
b. Manufacturer / Supplier:
c. Style Name and Number:
d. Color Name and Number:
e. Size: in by in by in (mm by mm by mm) thick.
f. Pattern: As indicated on the Drawings.
g. Grout Color:

1) Manufacturer:
2) Color Name and Number:

h. Trim: Provide tile trim and accessories that match color and finish of adjoining flat tile as required to prevent unfinished edges of tile from being exposed to view.

3. T03:

a. Type: Stone Wall and Floor Tile.
b. Manufacturer / Supplier:

c. Name and Number:
d. Finish:
e. Size: in by in by in (mm by mm by mm) thick.
f. Pattern: As indicated on the Drawings.
g. Edges: Square with eased exposed corner.
h. Grout Color:

1) Manufacturer:
2) Color Name and Number:

i. Trim: Provide tile trim and accessories that match color and finish of adjoining flat tile as required to prevent unfinished edges of tile from being exposed to view.

4. T04:

a. Type: Terrazzo Floor Tile.
b. Manufacturer / Supplier:
c. Style Name and Number:
d. Color Name and Number:
e. Size: in by in by in (mm by mm by mm) thick.
f. Pattern: As indicated on the Drawings.
g. Edges: Square with eased exposed corner.
h. Grout Color:

1) Manufacturer:
2) Color Name and Number:

i. Trim: Provide tile trim and accessories that match color and finish of adjoining flat tile as required to prevent unfinished edges of tile from being exposed to view.

D. 095113 - Acoustical Ceilings

1. ACT01:

a. Manufacturer and Series:
b. Style:
c. Size: 12 in (300 mm) x 12 in (300 mm) x 3/4 in (19 mm)
d. Item No.:
e. Color:
f. Edge Detail:
g. Grid System:

E. 095133 - Acoustical Metal Panel Ceilings

1. AMC01:

a. Manufacturer and Series:
b. Style:
c. Size:
d. Color:
e. Perforations:
f. Edge Detail:
g. Item No.:
h. Grid System:

F. 095135 - Snap-In Metal Pan Ceilings

1. SMC01:

a. Manufacturer:

b. Pan Pattern: [Smooth, flat, no perforations[Perforated]
c. Pan Edge Detail: [Square][Beveled][Round]
d. Size:
e. Scoring:
f. Pan Face Material: [Aluminum Sheet][Steel Sheet][Stainless Steel Sheet]
g. Pan Face Finish: [Clear Anodized][Clear Mirror Anodized][Powder-Coat or Baked Enamel][Chemical/Mechanical Bright Reflective][Directional Satin Finish: No. 4][Satin, Reflective, Directional Polish: No. 7][Mirrorlike Reflective, Nondirectional Polish: No. 8 finish].

G. 095423 - Linear Metal Ceilings

1. MCP01:

a. Manufacturer:
b. Pan Pattern:
c. Edge Detail: [Beveled] [Square] [Round]
d. Linear Module Width and Pan Face Width:
e. Material: [Aluminum Sheet][Steel Sheet][Stainless Steel Sheet]
f. Finish: [Clear Anodized][Clear Mirror Anodized][Powder-Coat or Baked Enamel][Organic][Chemical/Mechanical Bright Reflective][Directional Satin Finish: No. 4][Satin, Reflective, Directional Polish: No. 7][Mirrorlike Reflective, Nondirectional Polish: No. 8 finish].
g. Color:

H. 095436 - Suspended Decorative Grids

1. SDG01:

a. Manufacturer:
b. Cell Module Size:
c. Material: [Aluminum][Steel]
d. Finish: [Clear Anodized][Clear Mirror Anodized][Powder-Coat or Baked Enamel][Bright Reflective].
e. Color:

I. 096116 - Liquid Floor Hardener

1. Liquid Floor Hardener (i.e., Sealed Concrete): Clear

J. 096340 - Thick-Set Stone Flooring

1. For stone floor tiles, refer to Section 09 300
2. Stone: STXX; See Stones above.

K. 096500 - Resilient Flooring

1. Resilient Sheet Flooring

a. SHV01 - Sheet Vinyl Flooring

1) Manufacturer:
2) Product:
3) Color:
4) Seam Treatment: [Heat Weld] [Chemical Bonded]
5) Base: [Integral] [Separate][6 in (150 mm) high]
6) Welding Rod Color:

b. SHR01 - Sheet Rubber Flooring

1) Manufacturer:
2) Product:
3) Color:
4) Seam Treatment: [Heat Weld] [Chemical Bonded]
5) Base: [Integral] [Separate][6 in (150 mm) high]
6) Welding Rod Color:

c. SHL01 - Sheet Linoleum Flooring

1) Manufacturer:
2) Product:
3) Color:
4) Seam Treatment: [Heat Weld] [Chemical Bonded]
5) Base: [Integral] [Separate][6 in (150 mm) high]

2. Resilient Tile Flooring

a. VCT01 - Vinyl Composition Tile

1) Manufacturer:
2) Pattern:
3) Size: 1/8 in (3 mm) x 12 in (300 mm) x 12 in (300 mm)
4) Color Selection:

b. VT01 - Solid Vinyl Tile

1) Manufacturer:
2) Pattern:
3) Size: 1/8 in (3 mm) x 12 in (300 mm) x 12 in (300 mm)
4) Color Selection:

c. RT01 - Rubber Floor Tile

1) Manufacturer:
2) Pattern:
3) Size: 1/8 in (3 mm) x 12 in (300 mm) x 12 in (300 mm)
4) Color Selection:

d. LT01 - Linoleum Floor Tile

1) Manufacturer:
2) Pattern:
3) Size:
4) Color Selection:

L. 096513 - Resilient Base and Accessories

1. RB01:

a. Manufacturer:
b. Height: [2-1/2 in (62 mm)] [4 in (100 mm)] [6 in (150 mm)]
c. Type: [Coved at VCT] [Straight at Carpet]
d. Color Selection:

2. RB02: Resilient Stair Accessory

a. Manufacturer:
b. Style:
c. Color Selection:

M. 096520 - Interlocking Rubber Tile Flooring

1. ITF01:
    a. Manufacturer:
    b. Pattern:
    c. Size:
    d. Color Selection:

N. 096603 - Precast Terrazzo Flooring at Stairs

1. TER01:
    a. Color and Pattern: [NTMA Plate No. XX]

O. 096613 - Thick-Set Terrazzo

1. TER01:
    a. Color and Pattern: [NTMA Plate No. XX]
    b. Divider Strips: [White zinc allow][Half-hard brass][Plastic]
    c. Divider Strip Size: [1/8 in (3 mm)][1/4 in (6 mm)][3/8 in (10 mm)]

P. 096623 - Thin-Set Terrazzo

1. TER01:
    a. Color and Pattern: [NTMA Plate No. XX]
    b. Divider Strips: [White zinc allow][Half-hard brass][Plastic]
    c. Divider Strip Size: [1/8 in (3 mm)][1/4 in (6 mm)][3/8 in (10 mm)]

Q. 096723 - Resinous Flooring

1. RF01:
    a. Manufacturer:
    b. Color and Pattern:
    c. Texture:
    d. Thickness:

R. 096800 - Carpeting

1. Sheet Carpeting
    a. CP01:
        1) Manufacturer:
        2) Name:
        3) Series:
        4) Pattern:
        5) Number:
        6) Color:
2. Tile Carpeting
    a. CPT01:
        1) Manufacturer:
        2) Name:
        3) Series:
        4) Pattern:
        5) Number:
        6) Size:
        7) Color:

S. 097200 - Wall Coverings

1. WC01:

a. Manufacturer:
b. Type:
c. Style:
d. Color:

T. 097500 - Interior Stone Facing

1. For stone wall tiles, refer to Section 09 300
2. Stone: STXX; See Stones above.

U. 097723 - Fabric Wrapped Panels

1. FP01:

a. Panel Thickness: 3/4 in (19 mm) unless otherwise indicated.
b. Panel Edge Profile: Beveled unless otherwise indicated.
c. Fabric:

1) Manufacturer:
2) Pattern:
3) Style Number:
4) Color:
5) Fiber Content:
6) Applied Treatments: Stain resistant and flame resistant.

V. 098433 - Acoustical Wall Panels

1. AP01:

a. Manufacturer:
b. Facing Material: Manufacturer'¢s standard fabric from same dye lot; color and pattern as selected by Architect from manufacturer'¢s full range.
c. Nominal Core Density: Not less than 13 lb/cu. ft.
d. Panel Thickness: 3/4 in (19 mm) unless otherwise indicated.
e. Noise Reduction Coefficient: For Type A mounting per ASTM E 795 NRC 0.50 to 0.90.
f. Panel Width: Manufacturer'¢¢s standard.
g. Panel Height: As indicated

W. 099100 - Painting

1. Interior Paint Colors:

a. PT101:

1) Manufacturer:
2) Number:
3) Sheen:
4) Texture:
5) Color:
6) Type:

b. IPT01:

1) Manufacturer:
2) Number:
3) Sheen:

4) Texture:
5) Color:
6) Type:

X. 099413 - Textured Interior Coatings

1. TIC01:

a. Manufacturer:
b. Texture:
c. Color:

Y. 099600 - High Performance Coatings

1. HPC01:

a. Manufacturer:
b. Number:
c. Sheen:
d. Texture:
e. Color:

Z. 099613 - Multicolored Interior Coatings

1. MIC01:

a. Manufacturer:
b. Texture:
c. Color:

2.9 DIVISION 10 SELECTIONS BY SECTION

A. 102113 - Toilet Compartments

1. High Pressure Decorative Laminate: PLXX; See Plastic Laminates above.
2. Baked Enamel:

a. Color Selection: As selected from manufacturer's standard colors
b. Color Selection: Special Custom Color as selected

B. 102115 - Cubicle Specialties

1. CC01: (Fabric)

a. Manufacturer:
b. Pattern:
c. Color:

C. 102223 - Accordion Folding Partition

1. APF01: (Vinyl Wall Covering)

a. Manufacturer:
b. Selection:

D. 102238 - Operable Panel Partitions

1. OPF01:

a. Wall Carpet:
b. Vinyl Wall Covering:
c. Plastic Laminate:
d. Fabric Wall Covering:

e. Wood Veneer:
f. Paint:
g. Cap Finish:

E. 102613 - Wall and Corner Guards

1. Manufacturer:
2. Color Selection:

F. 105113 - Metal Lockers

1. Color: As selected from manufacturer's standard colors.
2. Color: As selected from custom colors.

G. 105116 - Wood Lockers

1. High Pressure Decorative Laminate: See Plastic Laminates above
2. Wood Species: See Woods above.

2.10 DIVISION 12 SELECTIONS BY SECTION

A. 122113 - Horizontal Louver Blinds

1. HB01:

a. Exterior Color:
b. Interior Color:

B. 122116 - Vertical Louver Blinds

1. VB01:

a. Color Selection:

C. 122413 - Roller Window Shades

1. RS01:

a. Color Selection:

D. 12 2500 - Between Glass Blinds

1. Color Selection:

E. 123640 - Stone Countertops

1. Stone: STXX; See Stones above.
2. Sealant Color: [Transparent] [White]

F. 123661 - Simulated Stone Countertops

1. Simulated Stone Fabrication Selection: SSFXX; See Simulated Stone above.

G. 124816 - Entrance Foot Grilles

1. FG01:

a. Material Type: Aluminum
b. Finish Type: Anodized
c. Anodized Color: [Clear][Champagne][Light bronze][Medium bronze][Dark bronze][Black]

2. FG02:

a. Material Type: Stainless Steel

b. Finish: [Mill][Directional Satin Finish: No. 4]

H. 124843 - Floors Mats

1. FM01:

a. Aluminum Finish: Anodized

1) Color: [Clear][Bronze][Black]

b. Carpet Inserts:
c. Vinyl Inserts:

2.11 DIVISION 14 SELECTIONS BY SECTION

A. 142100 - Electric Traction Elevators

1. Cab Interior Finishes Selections:

a. Custom as indicated on drawings
b. Floor:
c. Base:
d. Side and Rear Walls:
e. Front Return Panel, Door Post and Transom Panel:
f. Car Doors:
g. Handrail:
h. Pad Hooks:
i. Ceiling:

2. Hoistway Entrances:

a. First Floor:

1) Doors: [#4 finish stainless steel]
2) Frames: [#4 finish stainless steel]

b. Typical Floor:

1) Doors: [Prime Paint]
2) Frames: [Prime Paint]

B. 142400 - Hydraulic Elevators

1. Cab Interior Finishes Selections:

a. Custom as indicated on drawings
b. Floor:
c. Base:
d. Side and Rear Walls:
e. Front Return Panel, Door Post and Transom Panel:
f. Car Doors:
g. Handrail:
h. Pad Hooks:
i. Ceiling:

2. Hoistway Entrances:

a. First Floor:

1) Doors: [#4 finish stainless steel]
2) Frames: [#4 finish stainless steel]

b. Typical Floor:

1) Doors: [Prime Paint]
2) Frames: [Prime Paint]

PART 3 - EXECUTION - Not Used

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 011000

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Phased construction.
3. Work by Owner.
4. Work under separate contracts.
5. Future work.
6. Purchase contracts.
7. Owner-furnished, Owner-installed (OFOI) products.
8. Owner-furnished, Contractor-installed (OFCI) products.
9. Worker conduct and appearance - work rules.
10. Healthcare facility renovation work.
11. Access to site.
12. Coordination with occupants.
13. Work restrictions.
14. Specification and drawing conventions.
15. Miscellaneous provisions.

1.2 PROJECT INFORMATION

A. Project Identification: <Insert Project identifier such as Project name >.

1. Project Location: <Insert Project location (street address, city, and state)>.

B. Owner: <Insert name and address of Owner>.

1. Owner's Representative: <Insert name and contact information for Owner's representative>.

C. Architect: <Insert name and contact information for Architect>.

D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. <Insert title of design discipline>: <Insert name and contact information for consultant>.

E. Other Owner Consultants: The Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. <Insert title of design discipline>: <Insert name and contact information for consultant>. <Insert title of design discipline> has prepared the following portions of the Contract Documents:

a. <Insert description of scope of service for other Owner consultant>.

F. Contractor: <Insert name and contact information for Contractor> has been engaged as Contractor for this Project.

G. Construction Manager: <Insert name and contact information for Construction Manager>.

1. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for Construction between Owner

and Contractor, according to a separate contract between Owner and Construction Manager.

2. Construction Manager for this Project is Project's constructor. In Divisions 01 through 33 Sections, the terms "Construction Manager" and "Contractor" are synonymous.

H. Design-Builder: <Insert name and contact information for Design-Builder>.

1. Design-Builder has been engaged for this Project to provide architectural and engineering services and to serve as Project's constructor. In Divisions 01 through 33 Sections, the terms "Design-Builder" and "Contractor" are synonymous.

I. Project Web Site: A project Web site administered by Architect will be used for purposes of managing communication and documents during the construction stage.

1. See Division 01 Section "Project Management and Coordination" for requirements for establishing, administering, and using the Project Web site.

1.3 PHASED CONSTRUCTION

A. The Work shall be conducted in multiple phases as indicated on the drawings, with each phase substantially complete and ready for occupancy before commencement of subsequent phases.

B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for all phases of the Work.

1.4 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

1. <Insert a brief description of work performed by Owner>.

C. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. <Insert a brief description of work performed by Owner>.

D. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1. <Insert a brief description of work performed by Owner>.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Preceding Work: Owner [has awarded] [will award] separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

1. <Insert name of the Contract>: To <Insert name of separate Contractor> [to] [for] <Insert a brief description of work performed under separate contract>.

C. Concurrent Work: Owner [has awarded] [will award] [and will assign to Contractor] separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. <Insert name of the Contract>: To <Insert name of separate Contractor> [to] [for] <Insert a brief description of work performed under separate contract>.

D. Subsequent Work: Owner [has awarded] [will award] separate contract(s) for the following additional work to be performed at site following Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1. <Insert name of the Contract>: To <Insert name of separate Contractor> [to] [for] <Insert a brief description of work performed under separate contract>.

1.6 FUTURE WORK

A. The Contract Documents include requirements that will allow Owner to carry out future work following completion of this Project; provide for the following future work:

1. <Insert description of future work requiring consideration during construction of the Work of this Contract>.

1.7 PURCHASE CONTRACTS

A. General: Owner has negotiated purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.

1. Contractor's responsibilities are same as if Contractor had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

B. Purchase Contracts Information:

1. <Insert product name>: See Division <Insert MF04 Division number> Section "<Insert MF04 Section name>."

a. Purchase Contract Firm and Representative: <Insert name and contact information for purchase contract firm and representative.>
b. Purchase Contract Scope: [Furnishing material] [Material and installation labor] <Insert description of contract>.
c. Purchase Status: [Price negotiated by Owner, to be incorporated in the Contract Sum by Contractor; see Division 01 Section "Allowances" for cash allowance for purchase contract] [Price negotiated and incorporated in the Contract Sum by Contractor] [Product reserved by Owner] [Order placed and deposit paid by Owner] [Order to be placed by Contractor] <Insert description of status of purchase contract>.
d. Quantity: <Insert quantity ordered>.
e. Other Requirements: <Insert special requirements>.

1.8 OWNER-FURNISHED, OWNER-INSTALLED (OFOI) PRODUCT

A. The specific product is not in this contract, and actual installation of the product will be made by the Owner.

B. Products will be indicated as follows:

1. Product prefixed with "Space for"
2. N.I.C.

3. Owner Furnished - Owner Installed
4. Product noted as "Future"

C. Roughing-in for Owner Furnished, Owner Installed Product is provided by applicable Sections governing the type of work. Obtain rough-in requirements from Owner.

1.9 OWNER-FURNISHED, CONTRACTOR-INSTALLED (OFCI) PRODUCT

A. Install products indicated as follows:

1. "Owner Furnished, Contractor Installed".
2. "Reuse".
3. "Relocate".

B. Provide labor, transportation, materials, tools, appliances and utilities necessary for the following:

1. Relocated Products:

a. Removing installed product from the Owner's existing facility, as required.
b. Transportation of product from Owner's facility to the job site.

2. Receiving and storage of Owner furnished, Contractor installed product, as required.
3. Providing materials and components for the product as necessary to install in an operating condition, but not including repairing of existing damages to the product.
4. Modification of product only as specified under the particular item.
5. Installation of product in this project, complete and in operating condition, including the adjusting and calibration of the product as necessary for proper operation.
6. Testing of product.
7. Paying of fees, licenses, and taxes in conjunction with the installation of the product.
8. Roughing-in and final utility connections for the Owner furnished, Contractor installed product remains the work of Sections governing the specific utility.

1.10 WORKER CONDUCT AND APPEARANCE - WORK RULES

A. General: The conduct and appearance of each worker at the jobsite is of paramount importance. The Owner reserves the right to require any worker to be reassigned to work outside the Owner's property.

1. Privacy: Where applicable, conduct work of the Contract with the maximum effort to maintain the privacy of the Owner's operations, staff, and clientele. Do not permit workers to peer into other areas of the building visible from the work area. Invasion of privacy is a major infraction of the work rules.
2. Conduct and Demeanor: Construction workers shall treat other construction workers, Owner's staff, clientele, and visitors (as applicable) professionally with respect and courtesy.
3. Physical Appearance: Require each worker to dress appropriately in a clean, neat, and professional manner.
4. Radios and Television: The use of entertainment devices including personal devices with headphones or earphones is prohibited at all times. Control the volume of communication radios and loudspeakers to avoid creating a nuisance.
5. Tobacco Products: The use of tobacco products is prohibited.
6. Language: The use of foul language is prohibited.
7. Loud Conduct: Screaming, yelling, and unnecessary loud conduct is prohibited.
8. Physical Actions: Running, horseplay, fighting, and other unprofessional conduct is prohibited. Fighting is a major infraction of the work rules.
9. Stealing: Stealing of any material, objects, furnishings, equipment, fixtures, supplies, clothing, or other items is prohibited and a major infraction.

10. Sexual Harassment: All forms of physical and verbal sexual harassment including, without limitation: touching; whistling; sexually explicit stories, jokes, drawings, photos, and representations; exhibitionism; and all other sexually oriented offensive behavior is prohibited.
11. Roaming: Construction personnel shall not be allowed to roam, or wander about, the existing facilities.
12. Eating: Construction personnel shall not use the existing Dining Area for breakfast, lunch, or dinner.
13. Parking: Construction personnel shall only park in designated areas reserved for construction parking.
14. Penalties: First infraction of the work rules shall result in a verbal warning from the Owner. Second infractions shall result in being requested to leave the Owner's property. Owner's decision in such matters shall be final with no exceptions.

B. Warnings and Dismissal: For minor infraction of the rules, the Owner may issue a warning. Only one warning will be allowed per worker, and a second infraction shall result in immediate dismissal of the worker from the Owner's property. For major infractions such as invasion of privacy, the worker shall be dismissed immediately without warning and possibly subject to criminal prosecution.

C. Notification of Workers: Clearly notify and educate each worker about these Work Rules and the requirements for worker conduct and appearance.

1.11 HEALTHCARE FACILITY RENOVATION WORK

A. Interim Life Safety Measures (ILSM): The following Interim Life Safety Measures (ILSM) as established by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) shall be implemented, documented and enforced in and adjacent to all construction areas:

1. Ensure that exits provide free and unobstructed egress. Personnel shall receive training, and the Hospital shall be notified if alternative exits must be designated. Buildings/areas under construction must maintain escape facilities for construction workers at all times. Means of egress in construction areas must be inspected daily.
2. Ensure free and unobstructed access to emergency department/service and for emergency forces.
3. Ensure that fire alarm, detection, and suppression systems are not impaired. A temporary, but equivalent, system shall be provided, and the Hospital shall be notified, when any fire system is impaired. Temporary systems must be inspected and tested monthly.
4. Ensure temporary construction partitions are smoke tight and built of non-combustible or limited combustible materials that will not contribute to the development or spread of fire.
5. Provide additional fire-fighting equipment and use training for personnel.
6. Prohibit smoking in or adjacent to all construction areas.
7. Develop and enforce storage, housekeeping, and debris-removal practices that reduce the flammable and combustible fire load of the building to lowest level necessary for daily operations.
8. Conduct a minimum of two fire drills per shift per quarter.
9. Increase hazard surveillance of buildings, grounds, and equipment with special attention to excavations, construction areas, construction storage, and field offices.
10. Train personnel, and notify the Hospital, when structural or compartmentation features of fire safety are compromised.
11. Conduct organization wide safety education programs to assure awareness of deficiencies, construction hazards, and these ILSM.

1.12 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

C. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Confine constructions operations to work in areas indicated on drawings.
2. Allow for Owner occupancy of site and use by the public.
3. Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times.
4. Do not use drives and entrances for parking or storage of materials.
5. Schedule deliveries to minimize use of driveways and entrances.
6. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
7. Coordinate use of premises under direction of Owner.
8. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.
9. Move any stored Products, under Contractor'¢¢s control, which interfere with operations of the Owner or separate contractor.
10. Obtain and pay for the use of additional storage or work areas needed for operations.

D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.13 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing and/or adjacent building(s), as applicable, during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

C. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.14 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of <Insert time> a.m. to <Insert time> p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: <Insert restrictions on times permitted for weekend work>.
2. Early Morning Hours: <Insert restrictions or references to regulations by authorities having jurisdiction for restrictions on noisy work>.
3. Hours for Utility Shutdowns: <Insert Owner's restrictions>.
4. Hours for [Core Drilling] <Insert noisy activity>: <Insert Owner's restrictions>.

C. On-Site Work Hours: Coordinate the limitations relative to working hours in the existing building with Owner.

D. Existing Utility Interruptions: Refer to Division 01 Section "Execution" for requirements.

E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than 72 hours in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

1.15 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe

responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

3. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

1.16 MISCELLANEOUS PROVISIONS

A. <Insert miscellaneous provisions>.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 012100

ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.2 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.3 SUBMITTALS

A. Proposals: Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Material Invoices: Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Labor Documentation: Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

D. Coordination: Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.4 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.5 LUMP-SUM AND UNIT-COST ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.6 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.7 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Schedule of Allowances to be determined.

B. Face Brick: Allow the unit cost of $XXX per 1,000 for purchase and delivery of Face Brick.

C. Door Hardware: Allow the lump sum of $XXX for purchase and delivery of Door Hardware.

D. Wall Covering: Allow the unit cost of $XXX per sq. yd. for purchase and delivery of Wall Covering.

E. Carpeting: Allow the unit cost of $XXX per sq. yd. for purchase and delivery of Carpeting.

F. Elevator Car Enclosures: Allow the unit cost of $XXX per car for purchase and delivery of Elevator Car Enclosures.

G. Graphics: Allow the lump sum of $XXX for purchase, delivery, and installation of Graphics.

H. Landscaping: Allow the lump sum of $XXX for purchase, delivery, and installation of Landscaping.

I. Trowelable Polymer-Modified Cementitious Underlayment: Refer to Division 09 Section "Floor Preparation for Renovation Work" for allowance description and price.

J. Self-Leveling Cementitious Underlayment: Refer to Division 09 Section "Floor Preparation for Renovation Work" for allowance description and price.

K. Moisture Floor Treatment: Refer to Division 09 Section "Floor Preparation for Renovation Work" for allowance description and price.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 012200

UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

1.2 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Schedule of Unit Prices to be determined.

B. Item No. 1 - Rock Excavation:

1. Description: Rock excavation in accordance with Division 31 Section Earthwork.
2. Unit of Measurement: Cubic yard of rock excavated.

C. Item No. 2 - Drilled Piers, 36 in (900 mm), 30 in (750 mm), 24 in (600 mm), and 18 in (450 mm) diameters:

1. Description: Change in length of drilled piers from lengths indicated in accordance with Division 31 Section Drilled Piers, includes drilling and placing concrete and reinforcement (add for additional length for each diameter; deduct for reduced length for each diameter - not less than 65% of add cost).
2. Unit of Measurement: Linear foot of pier, for each pier diameter.

D. Item No. 3 - Cased Piers, 36 in (900 mm), 30 in (750 mm), 24 in (600 mm), and 18 in (450 mm) diameters:

1. Description: Change in length of cased piers from lengths indicated in accordance with Division 31 Section Drilled Piers, includes drilling and placing concrete and reinforcement (add for each pier diameter; deduct for reduction of base bid casing for each pier diameter - not less than 65% of add cost).
2. Unit of Measurement: Linear foot of cased pier, for each pier diameter.

E. Item No. 4 - Prestressed Precast Concrete Piles:

1. Description: Change in length of pile from lengths indicated in accordance with Division 31 Section Prestressed Precast Concrete Piles.
2. Unit of Measurement: Linear foot of pile driven.

F. Item No. 5 - Reinforcing Steel:

1. Description: Adding additional reinforcing steel from amount indicated in accordance with Division 3 Section Reinforcing Steel, includes furnishing, fabricating, and installing.
2. Unit of Measurement: Ton of reinforcing steel installed.

G. Item No. 6 - Structural Steel Framing:

1. Description: Adding additional structural steel from amount indicated in accordance with Division 5 Section Structural Steel Framing, includes furnishing, fabricating, and installing.
2. Unit of Measurement: Ton of structural steel installed.

H. Item No. 7 - Carpet:

1. Description: Wool carpet type 1 including urethane foam carpet cushion and tackless strip in accordance with Division 9 Section Sheet Carpeting.
2. Unit of Measurement: Square yard of carpet installed.

I. Item No. 8 - Fire Alarm Devices:

1. Description: Fire alarm system devices as follows, including outlet boxes, wiring, connectors, and coverplates:

   a. Fire alarm smoke detectors
   b. Fire alarm audio / visual devices
   c. Fire alarm visual only devices
   d. Fire alarm pull stations

2. Unit of Measurement: Each device installed.

J. Item No. 9 - Electrical Devices:

1. Description: Electrical system devices as follows, including outlet boxes, wiring, connectors, and coverplates:

   a. Duplex receptacles
   b. Quad receptacles
   c. Exit lights
   d. Telephone / data devices

2. Unit of Measurement: Each device installed.

K. Item No. 10 - Electrical Outlets:

1. Description: Galvanized steel outlet boxes, including general duty type, 125-volt, duplex receptacles, connectors and satin finish stainless steel wallplates.
2. Unit of Measurement: Each outlet installed.

L. Item No. 11 - Trowelable Polymer-Modified Cementitious Underlayment:

1. Description: Refer to Division 09 Section "Floor Preparation for Renovation Work" Unit Price.

M. Item No. 12 - Self-Leveling Cementitious Underlayment:

1. Description: Refer to Division 09 Section "Floor Preparation for Renovation Work" Unit Price.

N. Item No. 13 - Moisture Floor Treatment:

1. Description: Refer to Division 09 Section "Floor Preparation for Renovation Work" Unit Price.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 012300

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Documentation: Show compliance with requirements for accepted alternates and the following, as applicable:

1. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate accepted alternates.
2. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
3. Samples, where applicable or requested.
4. Certificates and qualification data, where applicable or requested.
5. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
6. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
7. Detailed comparison of Contractor's construction schedule using accepted alternates with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
8. Cost information, including change in the Contract Sum.

B. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

C. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

D. Execute accepted alternates under the same conditions as other work of the Contract.

E. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

F. Acceptance of Alternates will be exercised at option of Owner in any order or combination.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Schedule of Alternates to be determined.

B. ALTERNATE NO. 1: <Title of Alternate>

1. Refer to Division <DIVISION NUMBER> Section "<NAME OF SECTION>"
2. [Add] [Delete] [Change] [Description of Alternate].

C. ALTERNATE NO. 2: <Title of Alternate>

1. Refer to Division <DIVISION NUMBER> Section "<NAME OF SECTION>"
2. [Add] [Delete] [Change] [Description of Alternate].

D. ALTERNATE NO. 3: <Title of Alternate>

1. Refer to Division <DIVISION NUMBER> Section "<NAME OF SECTION>"
2. [Add] [Delete] [Change] [Description of Alternate].

E. ALTERNATE NO. 4: <Title of Alternate>

1. Refer to Division <DIVISION NUMBER> Section "<NAME OF SECTION>"
2. [Add] [Delete] [Change] [Description of Alternate].

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 SUBMITTALS

A. Substitution Requests: Submit electronic copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Submit electronic file using Architect's Substitution Request Form.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's

letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, with reasonable promptness, Architect will request additional information or documentation for evaluation. Architect will notify Contractor of acceptance or rejection of proposed substitution with reasonable promptness. Acceptance of proposed substitution does not constitute approval or inclusion in Contract Documents. Pay applications certification, change orders, and certificate of substantial completion will contain such qualification.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Prior to starting Substitution Process, review proposed recommendations with Architect.

B. Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples for construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.

C. Contractor Representations: By making substitution request, Contractor:

1. Recognizes burden of proof of equality for requested substitution rests with Contractor.
2. Represents and warrants that Contractor has personally investigated requested substitution and determined that it is equal to or superior in all respects to specified Work.
3. Represents and warrants that Contractor will provide same warranties for requested substitution that Contractor would for specified Work.
4. Certifies that cost data presented is complete and includes all related costs under this Contract except for Architect's redesign cost, and waives all claims for additional costs related to requested substitution which may subsequently become apparent.
5. Will coordinate installation of accepted substitution, making such other changes as may be required to make Work complete in all respects.
6. Represents and warrants that accepted substitution will perform same as specified Work would have performed. Should accepted substitution fail to perform as required, Contractor shall replace accepted substitution with specified Work at no additional cost to Owner.

D. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

    a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    b. Requested substitution provides sustainable design characteristics that specified product provided.
    c. Substitution request is fully documented and properly submitted.
    d. Requested substitution will not adversely affect Contractor's construction schedule.
    e. Requested substitution has received necessary approvals of authorities having jurisdiction.
    f. Requested substitution is compatible with other portions of the Work.
    g. Requested substitution has been coordinated with other portions of the Work.
    h. Requested substitution provides specified warranty.

E. Substitutions for Convenience:

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

    a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    b. Requested substitution does not require extensive revisions to the Contract Documents.
    c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    d. Requested substitution provides sustainable design characteristics that specified product provided.
    e. Substitution request is fully documented and properly submitted.
    f. Requested substitution will not adversely affect Contractor's construction schedule.
    g. Requested substitution has received necessary approvals of authorities having jurisdiction.
    h. Requested substitution is compatible with other portions of the Work.
    i. Requested substitution has been coordinated with other portions of the Work.
    j. Requested substitution provides specified warranty.

PART 3 - EXECUTION (Not Used)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 012600
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, using Architect's Supplemental Instructions Form.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposed Change: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time using Architect Proposed Change Form. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposed Changes issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposed Change or with reasonable promptness, when not otherwise specified, after receipt of Proposed Change, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
e. Include updated Submittal Schedule showing effect of the change.

B. Contractor-Initiated Proposed Change: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect using Contractor’s Standard Form.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times,

and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Include updated Submittal Schedule showing effect of the change.
7. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: If applicable, see Division 01 Section "Allowances" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: If applicable, see Division 01 Section "Unit Prices" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of unit-price work.

C. Alternates: If applicable, see Division 01 Section "Alternates" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of alternate work.

1.5 CHANGE ORDER PROCEDURES

A. Upon Owner's approval of a Proposed Change, Architect will issue a Change Order for signatures of Owner and Contractor using Architect's Change Order Form.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive using Architect's Construction Change Directive Form. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 012900
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Accepted Alternates.

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments; provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work; provide subschedules showing values coordinated with each element.
5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange the schedule of values in tabular form, in format accepted by Architect, with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.
b. Description of the Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders.
g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

1) Labor.

2) Materials.
3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance or bonded warehousing.

6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances (If Applicable): Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances (if applicable), as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Alternates (If Applicable): Provide a separate line item in the schedule of values for each accepted alternate.
9. Change Orders: Provide a separate line item in the schedule of values for each change order.
10. Separate Owner-Consultant Contracts: Provide a separate line item in the schedule of values for each separate Owner-Consultant related Work item.
11. Purchase Contracts: When applicable, provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
12. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

13. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 ARCHITECTS COST DATA

A. In addition to the Schedule of Values, submit itemized cost data reporting using Architect's Project Cost Summary Form. Initial submission shall be included with contractors first Application for Payment. Final updated submission shall be included with contractors final Application for Payment.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

1. If the Agreement does not state payment dates, establish dates at preconstruction conference.
2. Submit draft, or pencil, copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Unless directed otherwise by Owner, use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Stored Materials: If accepted by Owner, include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

   a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
   b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
   c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from General Contractor, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.

a. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Schedule of unit prices.
6. Submittal schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. When applicable, this application shall reflect Certificate(s) of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. If applicable, final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 013100
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project Web site.
5. Project meetings.

1.2 DEFINITIONS

A. Project communications documents shall be defined as the following:

1. Letters.
2. Memoranda.
3. E-Mail Communications/Internet Communications/Project Management Software Communications.
4. RFI (Request for Information - Contractor).
5. RFI-A (Request for Information - Architect).

1.3 FORMAT

A. Letters and Memoranda: Submit in formats acceptable to the Architect.

B. E–Mail Communications/Internet Communications/Project Management Software Communications: Submit in forms and formats acceptable to and as approved by the Architect.

C. RFI (Request for Information - Contractor): Submit using Architect's Request for Information Form, or on other forms approved by the Architect.

D. RFI-A (Request for Information - Architect): Architect will submit to Contractor using Architect's standard form.

1.4 PROJECT COMMUNICATIONS DOCUMENTS

A. Letters and Memoranda documents shall be submitted in a timely manner so as to facilitate project delivery and coordination. Routing of communications shall be as established in the Contract, the Contract Documents and the Pre-Construction Conference. Communications documents shall be transmitted or forwarded in a manner consistent with the schedule and progress of the work.

B. E–Mail Communications, Internet Communications, and Project Management Software programs must be compatible with the Architect’s and Owner’s computer systems and equipment. The responsibility for all costs for management of these systems, including, but not limited to, licensing, onsite training or other training necessary for the proper operation of such systems, shall be by the Contractor. The Contractor shall keep written records and hard file copies of all electronic communications. Failure of the Contractor to keep such records shall waive the Contractor’s right to rely on such communications and such communications shall be deemed to have not taken place.

C. RFI (Request for Information - Contractor) shall be defined and limited to a request from the Contractor seeking interpretation or clarification of the requirements of the Contract Documents. Such requests shall comply with the following requirements:

1. RFI requests shall be submitted in a timely manner, well in advance of related work, and allow sufficient time for the resolution of issues relating to the request for interpretation or clarification. Contractor shall schedule the submission of RFI's so as to moderate and manage the flow of RFI requests. RFI's shall be submitted in a manner consistent with the schedule and progress of the work, and shall not be submitted in a sporadic and/or excessive manner.
2. RFI requests shall be numbered in a sequential manner and contain a detailed description of the areas of work requiring interpretation or clarification. Include drawing and specification references, sketches, technical data, brochures, or other supporting data as deemed necessary by the Architect, for the Architect to provide the interpretations and clarifications requested.

   a. The Contractor shall include a "Proposed Solution" to the issue requiring interpretation or clarification.

3. RFI's submitted to the Contractor by Sub-Contractors, vendors, suppliers, or other parties to the work shall be reviewed by the Contractor prior to submission to the Architect. If the Architect deems that such RFI requests have not been adequately reviewed by the Contractor, such requests will be returned to the Contractor for further action. Sub-Contractor's RFI shall contain a "Proposed Solution".
4. RFI requests shall not contain submittals, substitutions requests, routine communications, correspondence, memos, claims, or any information required by other areas of the Contract Documents. RFI requests containing such information will be returned to the Contractor without action by the Architect.
5. RFI requests are limited to a request for interpretation or clarification of the requirements of the Contract Documents. Interpretations provided by the Architect shall not change the requirements of the Contract or the Contract Documents. If the Contractor determines that the Architect's response to an RFI gives cause for a change in the Contract or the Contract Documents, the Contractor shall promptly, within 5 working days, give written notice to the Architect of request for adjustments. Requests for adjustments to the Contract shall be submitted in a manner consistent with the terms and conditions of the Contract Documents.
6. If the Architect, after review, determines that any RFI has been submitted in an incomplete manner, is unnecessary, or does not otherwise comply with the requirements of this Section, the RFI will be returned without action to the Contractor. The Contractor shall delete the original submittal date from the RFI log and enter a new submittal date at the time of re-submittal.
7. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site. Software log with not less than the following:

   a. Project name.
   b. Name and address of Contractor.
   c. Name and address of Architect.
   d. RFI number including RFIs that were returned without action or withdrawn.
   e. RFI description.
   f. Date the RFI was submitted.
   g. Date Architect's response was received.

8. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

   a. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

D. RFI-A (Request for Information - Architect) shall be defined as a request by the Architect for information relating to the obligations of the Contractor under the Contract.

1. After receipt of an RFI-A the Contractor shall provide a written response to the Architect within 5 working days. Responses shall be thorough, complete and shall contain all information requested by the Architect.
2. An RFI-A shall be limited to a request by the Architect for information related to the project. The RFI-A shall not be construed as authorizing or directing a change in the Contract or the Contract Documents.

E. Revisions to Construction Documents: Responses to requests for information (RFI) shall not serve as construction documents; and the Contractor shall not incorporate RFI responses into construction of the Project, unless such answers bear the seal and signature of a licensed design professional.

1.5 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and Project Web site. Keep list current at all times.

1.6 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.7 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
e. Indicate required installation sequences.
f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.

2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
3. BIM File Incorporation: When applicable, develop coordination drawing files from Building Information Model (BIM) established for Project.
    a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
4. If approved by Owner, Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    b. Digital Data Software Program: Drawings are available in Autodesk Revit and/or Autocad; and compatible with Microsoft Windows operating system.
    c. Distribution: Digital data files shall be distributed via the Architect's file transfer site with acceptance of Architect's data licensing agreement.

1.8 PROJECT WEB SITE

A. Use Architect's Project Web site implementing Architect’s electronic project management software system for purposes of managing project communication and documentation until Final Completion.

1.9 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
    1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
    2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
    3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
    4. Attendance: Document attendance of all participants.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction.
    1. Conduct the conference to review responsibilities and personnel assignments.
    2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
    1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, and coordination with adjacent activities. Prepare agenda appropriate to Work.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, at a time to be decided prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

   a. Preparation of record documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Submittal of written warranties.
   d. If applicable, requirements for completing sustainable design documentation.
   e. Requirements for preparing operations and maintenance data.
   f. Requirements for delivery of material samples, attic stock, and spare parts.
   g. Requirements for demonstration and training.
   h. Preparation of Contractor's punch list.
   i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
   j. Submittal procedures.
   k. If applicable, coordination of separate contracts.
   l. If applicable, Owner's partial occupancy requirements.
   m. Installation of Owner's furniture, fixtures, and equipment.
   n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at regular intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following or as needed:

1) Interface requirements.
2) Sequence of operations.
3) If applicable, resolution of BIM component conflicts.
4) Status of submittals.
5) If applicable, status of sustainable design documentation.
6) Deliveries.
7) Off-site fabrication.
8) Access.
9) Site utilization.
10) Temporary facilities and controls.
11) Work hours.
12) Hazards and risks.
13) Progress cleaning.
14) Quality and work standards.
15) Status of correction of deficient items.
16) Field observations.
17) Status of RFIs.
18) Status of proposal requests.
19) Pending changes.
20) Status of Change Orders.
21) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings on an as-needed basis. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Review present and future needs of each contractor present, including the following:

1) Interface requirements.

2) Sequence of operations.
3) If applicable, resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.
10) Work hours.
11) Hazards and risks.
12) Progress cleaning.
13) Quality and work standards.
14) Change Orders.

PART 2 - PRODUCTS

2.1 ARCHITECT'S ELECTRONIC PROJECT MANAGEMENT SOFTWARE

A. General: Architect will process electronic document reviews using a cloud-based project information and document management software integrated with Procore. Documents via email, FTP or paper will not be accepted.

1. Basis of Design:

a. Tonic DM, web-based software.

1) Website: www.tonicdm.com
2) E-mail: support@tonicdm.com
3) Phone: (214) 631-4414

B. Performance Requirements:

1. Project License:

a. Cloud based (no hardware required).
b. Unlimited user accounts.
c. Functionality to support subcontractors, contractors, architects and consultants.
d. Provide access to data for all project team members at no cost to the individual users.

2. Training and Support:

a. Dedicated project training.
b. Phone support.

3. Archive:

a. Export all data to an offline archive at the completion of the project.
b. Provide archive to architect, contractor and owner.
c. Archive shall include all attachments, meta data, review comments and time stamp history.

4. Submittals and RFIs:

a. Customizable logs and reporting accessible by all users.
b. Logs shall automatically update as submittals and RFIs are processed.
c. Automated routing of submittals and RFIs to design team based on trade.

d. Automated email notifications when submittal or RFI has been assigned or returned to a user.
e. Automated weekly email to design team users of overdue items.
f. Automatic sequential numbering per spec section for submittals.
g. Two sets of due dates - one overall due date and a consultant due date.
h. Built-in web-based markup tools to support a concurrent review of submittal and RFI.

5. Submittal Register:

   a. Software vendor shall take specifications and build the required list of submittals and import into the software.

6. Drawing Management:

   a. Provide current set of drawings and specifications through a centralized index.
   b. Automated association of PDFs to the centralized index.
   c. Manage drawing revisions with customizable review states.
   d. Drawings shall be accessible offline via mobile devices.

7. File Sharing:

   a. Integrated file sharing tool (FTP) to transfer any miscellaneous files such as BIM and CAD files.
   b. Access permissions (view/edit) at a folder level.

8. Punch List and other Field Task Management:

   a. Unlimited customizable field task types including punch list.
   b. Locate and assign tasks from a mobile device.
   c. No additional fees to individual users to access mobile apps.
   d. Data shall be accessible offline on mobile devices.

PART 3 - EXECUTION (Not Used)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 013200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work.

B. Related Section:

1. Provide Construction Photographs in accordance with Division 01 Section "Photographic Documentation".

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Major Area: A story of construction, a separate building, or a similar significant construction element.

C. Milestone: A key or critical point in time for reference or measurement.

D. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

E. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

F. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

G. Event: The starting or ending point of an activity.

H. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

I. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

1.3 SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. PDF electronic file.

B. Startup Construction Schedule.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at weekly intervals.

H. Material Location Reports: Submit at monthly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Special Reports: Submit at time of unusual event.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
3. Startup and Testing Time: Include no fewer than 7 days for startup and testing.
4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule (where applicable), and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Products Ordered in Advance: Include a separate activity for each product.
4. Owner-Furnished Products: Include a separate activity for each product.
5. Work Restrictions: Show the effect of the following items on the schedule:

   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.
   d. Partial occupancy before Substantial Completion.
   e. Use of premises restrictions.
   f. Provisions for future construction.
   g. Seasonal variations.
   h. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

   a. Subcontract awards.
   b. Submittals.
   c. Purchases.
   d. Mockups.
   e. Fabrication.
   f. Sample testing.
   g. Deliveries.
   h. Installation.
   i. Tests and inspections.
   j. Adjusting.
   k. Curing.
   l. Building flush-out.
   m. Startup and placement into final use and operation.

7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

   a. Structural completion.
   b. Temporary enclosure and space conditioning.
   c. Permanent space enclosure.
   d. Completion of mechanical installation.
   e. Completion of electrical installation.
   f. Substantial Completion.

8. Other Constraints include but are not limited to the following:

   a. Roads.
   b. Parking.
   c. Landscape.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, punch list activities, Substantial Completion, and final completion.

E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within 14 days of date established for the Notice of Award.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. Startup Network Diagram may be submitted in lieu of Bar-Chart Schedule.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (BAR CHART/GANTT CHART)

A. Bar Chart/Gantt Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

   1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

   a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

   a. Preparation and processing of submittals.
   b. Purchase of materials.
   c. Delivery.
   d. Fabrication.
   e. Installation.
   f. Punch list and final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

   a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment, fragnet, to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

   a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
   b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. High and low temperatures and general weather conditions, including presence of rain or snow.
5. Accidents.
6. Meetings and significant decisions.
7. Unusual events (see special reports).
8. Stoppages, delays, shortages, and losses.
9. Meter readings and similar recordings.
10. Emergency procedures.
11. Orders and requests of authorities having jurisdiction.
12. Change Orders received and implemented.

13. Construction Change Directives received and implemented.
14. Services connected and disconnected.
15. Equipment or system tests and startups.
16. Partial completions and occupancies.
17. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.6 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to Architect-Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 013233
PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.
4. Preconstruction video recordings.
5. Periodic construction video recordings.
6. Web-based construction photographic documentation.

1.2 INFORMATIONAL SUBMITTALS

A. Qualification Data: For photographer and Web-based photographic documentation service provider.

B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph or video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

C. Digital Photographs: Submit image files within 3 days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 12 megapixels.
2. Format: Minimum 4288 by 2848 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Image File Naming Convention (separate by an underscore _):

a. Project Job Number / Year-Month-Day / Image Number . file extension

4. Identification: Provide the following information with each image description in file metadata tag:

a. HKS Job Number and Add Service Number (e.g. 07425.000).
b. Name of Project.
c. Name and contact information for photographer.
d. Name of Architect.
e. Name of Contractor.
f. Date photograph was taken.
g. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
h. Unique sequential identifier keyed to accompanying key plan.

D. Video Recordings: Submit video recordings within 7 days of recording.

1. Video Recordings, General:

a. Submit in digital video disc format acceptable to Architect.
b. Submit by posting to Project Web site.
c. Submit by posting to Web-based photographic documentation service provider's Web site.

2. Identification: With each submittal, provide the following information:

a. Name of Project.

b. Name and address of photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date video recording was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Weather conditions at time of recording.

3. Transcript: Provide Portable Data (PDF) Electronic File. Include a cover page with same label information as corresponding video recording. Include name of Project and date of video recording on each page.

E. Web-Based Photographic Documentation: Submit time-lapse sequence video recordings simultaneously with recording.

1. Real-time posting: Post in real-time, time-lapse sequence video recordings:

a. Post to Project Web site.
b. Post to Web-based photographic documentation service provider's Web site.

2. Periodic Posting: Monthly on digital video disc.
3. Identification: For each recording, provide the following information:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date(s) and time(s) video recording was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Weather conditions at time of recording.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

B. Web-Based Photographic Documentation Service Provider: A firm specializing in providing photographic equipment, Web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

1.4 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of megapixels, and at an image resolution of not less than 4288 by 2848 pixels.

B. Digital Video Recordings: Provide high-resolution, digital video disc in format acceptable to Architect.

2.2 WEB-BASED PHOTOGRAPHIC DOCUMENTATION

A. Project Camera: Provide fixed exterior camera installation, mounted to provide unobstructed view of construction site from location approved by Architect.

1. Provide 4 fixed-location camera(s), with the following characteristics:

a. Remotely controllable view with mouse-click user navigation for horizontal pan, vertical tile, and optical zoom of 500 percent minimum.
b. Capable of producing minimum 3 megapixel pictures.
c. Provide power supply, active high-speed data connection to service provider's network, and static public IP address for each camera.

B. Web-Based Image Access: Password-protected access for Project team administered by Contractor, providing current image access and archival image access by date and time, with images downloadable to viewer's device.

1. Provide public viewer open access to most recent project camera image.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

D. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag construction limits before taking construction photographs.
2. Take a minimum of 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take a minimum of 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

E. Periodic Construction Photographs: Take 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.

1. Frequency: Take photographs monthly, coinciding with the cutoff date associated with each Application for Payment.

2. Vantage Points: Following suggestions by Architect and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than 2 of the required shots from same vantage point each time to create a time-lapse sequence as follows:

   a. Commencement of the Work, through completion of subgrade construction.
   b. Above-grade structural framing.
   c. Exterior building enclosure.
   d. Interior Work, through date of Substantial Completion.

G. Drones (If Applicable): Flight Schedule per mutual agreement between the Owner and Contractor to show status of construction and progress.

H. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.

   1. Do not include date stamp unless directed otherwise by Architect.

I. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

   1. Three days' notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request.
   3. Circumstances that could require additional photographs include, but are not limited to, the following:

      a. Special events planned at Project site.
      b. Immediate follow-up when on-site events result in construction damage or losses.
      c. Photographs to be taken at fabrication locations away from Project site.
      d. Substantial Completion of a major phase or component of the Work.
      e. Extra record photographs at time of final acceptance.
      f. Owner's request for special publicity photographs.

3.2 CONSTRUCTION VIDEO RECORDINGS

A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.

B. Recording: Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project site.

C. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.

   1. Confirm date and time at beginning and end of recording.
   2. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.

D. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.

E. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Architect.

1. Flag construction limits before recording construction video recordings.
2. Show existing conditions adjacent to Project site before starting the Work.
3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of construction.
4. Show protection efforts by Contractor.

F. Periodic Construction Video Recordings: Record video recording monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes(s).

G. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.

1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every 5 minutes, from same vantage point each time, to create a time-lapse sequence of 30 minutes in length as follows:

a. Commencement of the Work, through completion of subgrade construction.
b. Above-grade structural framing.
c. Exterior building enclosure.

2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.
3. Vantage Points: Following suggestions by Architect and Contractor, photographer shall select vantage points.

3.3 WEB-BASED CONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

A. Live Streaming Construction Site Images: Provide Web-accessible image of current site image from viewer-controlled location camera(s), updated at 15 minute intervals during daytime operation.

B. Time-Lapse Sequence Construction Site Recordings: Provide video recording from a fixed-location camera to show status of construction and progress.

1. Frequency: Record one frame of video recording every 15 minutes, from same vantage point each time, to create a time-lapse sequence of construction activities.
2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.

C. Maintain cameras and Web-based access in good working order according to Web-based construction photographic documentation service provider's written instructions until final completion. Provide for service of cameras and related networking devices and software.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's review. Architect's responsive action is required.

B. Digital Signature: A digital signature or digital signature scheme is a mathematical scheme for demonstrating the authenticity of a digital message or document.

C. Electronic Signature: An electronic signature is any legally recognized electronic means that indicates that a person adopts the contents of an electronic message.

D. Informational Submittals: Written and graphic information other than action submittals that require Architect's review. Architect's responsive action is required on informational submittals that do not comply with the information given and design concept expressed in the Drawings and Specifications.

E. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

   a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action; informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for Architect's final release or approval.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: If approved by Owner, Architect will furnish Contractor one set of digital data files of Drawing files for use in preparing submittals. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

1. Distribution: Digital data files shall only be distributed with acceptance of HKS data licensing agreement.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow sufficient and reasonable time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. The Architect’s action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect’s professional judgment to permit adequate review.

D. Paper Submittals: Architect reserves the right to require paper submittals.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number, including revision identifier.

a. File Naming Convention (separate by dashes - or underscores _):

1) Specification Number / Revision Number / Submittal Sequence (A, B, C, etc.).pdf

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:

a. Project name.
b. Date.
c. Name and address of Architect.
d. Name of Contractor.

e. Name of firm or entity that prepared submittal.
f. Names of subcontractor, manufacturer, and supplier.
g. Category and type of submittal.
h. Submittal purpose and description.
i. Specification Section number and title.
j. Specification paragraph number or drawing designation and generic name for each of multiple items.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Related physical samples submitted directly.
n. Indication of full or partial submittal.
o. Transmittal number, numbered consecutively.
p. Submittal and transmittal distribution record.
q. Other necessary identification.
r. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. HKS Job Number and Add Service Number (e.g. 14424.000)
b. Project name.
c. Number and title of appropriate Specification Section.
d. Manufacturer name.
e. Product name.
f. Submittal revision number.

6. Utilize electronic project management software program to process submittals when feasible with the type and extent of submittals. Refer to Division 01 Section "Project Management and Coordination" for description of electronic project management software.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On page, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in file name and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with notation from Architect's action stamp not requiring additional submittals.

I. Distribution: Furnish electronic copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with appropriate notation from Architect's action stamp indicating for construction. Retain a separate copy for Owner to be delivered to Owner with Project Closeout documents.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals as PDF electronic files directly to Architect's Project Web site specifically established for Project.

   a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   b. Provide PDF electronic files from scanned paper originals at 300 dpi, minimum.

2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

   a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
   b. When one or more individual Specification Sections includes requirements for notarized signature on certificates and certifications, provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

   a. Manufacturer's written recommendations.
   b. Manufacturer's installation instructions.
   c. Mill reports.
   d. Standard product operating and maintenance manuals.
   e. Certification that products are appropriate for installation indicated.
   f. Manufacturer's catalog cuts.
   g. Manufacturer's product specifications.
   h. Standard color charts.
   i. Statement of compliance with specified referenced standards.
   j. Testing by recognized testing agency.
   k. Application of testing agency labels and seals.
   l. Notation of coordination requirements.
   m. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Dimensions.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Design calculations.
i. Schedules.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Relationship and attachment to adjoining construction clearly indicated.
n. Seal and signature of professional engineer.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (212 by 275 mm), but no larger than 30 by 42 inches (750 by 1050 mm).
4. Submit Shop Drawings in the following format:

a. PDF electronic file.

5. BIM File Incorporation: When applicable, develop and incorporate Shop Drawing files into Building Information Model established for Project.

a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
b. Refer to Division 01 Section "Project Management and Coordination" for requirements for coordination drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of applicable Specification Section.
e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record. This is in addition to physical samples.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit 4 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit 4 sets of Samples. Architect will retain 2 Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 4 sets of paired units that show approximate limits of variations.

E. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

K. Sustainable Construction Submittals: Where applicable, comply with requirements specified in Division 01 sustainable construction requirements Section.

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-ENGINEERING SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Engineering Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM File Incorporation: Where applicable, incorporate delegated-design drawing and data files into Building Information Model established for Project.

1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp and mark submittal appropriately, as follows:

1. Final but Restricted Release: When submittals are marked "Accepted as Noted," the Work covered by the submittal may proceed provided it complies with both the Architect's notations and corrections on the submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
2. Returned for Resubmittal: When submittal is marked "Revise Resubmit," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architect's

notations. Resubmit without delay. Repeat if necessary to obtain a different action mark.

a. Do not permit submittals marked "Revise Resubmit" to be used at the Project site, or elsewhere where construction is in progress.

3. Submittals Not Required: Where a submittal is primarily for record purposes, special processing, or other Contractor activity, the submittal will be returned, marked “Not Reviewed; Submittal not required by Contract Documents".
4. Reviewed for Architectural Issues Only: Review limited to Architectural Design Only. No review of other non-architectural disciplines was performed or implied.
5. Processed for Consultant Review: This Document has been processed for Consultant Review. The action performed was limited to forwarding the materials for review by the appropriate consulting disciplines. No technical evaluation, design validation, code analysis, or professional review of the content was performed by the processor. Responsibility for analysis, coordination, and discipline-specific review rests solely with the receiving consultant(s).

B. Architect's Acceptance of Shop Drawings, Samples or Product Data which deviates from the Contract Documents does not authorize changes to the Contract Sum. Submit in writing at the time of submission any changes to the Contract Sum affected by such Shop Drawings, Samples or Product Data, otherwise, claim for extras will not be considered.

C. Informational Submittals: Architect will review submittal, and return it in accordance with submittal Processing Time indicated if it does not comply with requirements. Architect will stamp and mark submittal appropriately.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect. Review shall not be final until complete submittal has been reviewed by Architect.

E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

F. Submittals not required by the Contract Documents may be returned by the Architect without action.

G. Electronic File of Submittal Documents: Provide Architect with an independent electronic archive of project submittal documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination".

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 014000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Cladding Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
2. Typical Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
3. Preconstruction Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL (Nationally Recognized Testing Laboratories), an NVLAP (National Voluntary Laboratory Accreditation

Program), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction and with the qualification requirements of individual specification section governing their work.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

C. If work is required in a manner that makes it impossible to produce such work of the quality required by or reasonably inferred from the Contract Documents, or should discrepancies appear among the Construction Documents, the Contractor shall request in writing an interpretation from the Architect before proceeding with the work. If the Contractor fails to make such request, no excuse will be entertained thereafter for failure to carry out work in the required manner or to produce required guarantees, warranties, or bonds, and the Contractor shall not be entitled to any change in the Contract Sum or the Contract Time on account of such failure.

1.4 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may be the Project superintendent or be an individual with no other Project responsibilities, as accepted by the Architect.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority when Commissioning is included in the Project.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results, including Owner acceptance of nonconforming work. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.5 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Statement whether conditions, products, and installation exceed manufacturer’s statements.
8. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Protect accepted mock-up from the elements with weather-resistant membrane.
6. Obtain Architect's acceptance of mock-ups before starting fabrication.
7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
8. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

L. Integrated Exterior Cladding Mockups: See Division 01 Section Visual Mock-Ups.

M. Typcial Room Mockups: See Division 01 Section Visual Mock-Ups.

N. Preconstruction Laboratory Mockups: See Division 01 Section "Preconstruction Laboratory Mockup Testing for Building Enclosure Systems."

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

a. Prepare in tabular form and include the following:

1) Specification Section number and title.
2) Entity responsible for performing tests and inspections.
3) Description of test and inspection.
4) Identification of applicable standards.
5) Identification of test and inspection methods.
6) Number of tests and inspections required.
7) Time schedule or time span for tests and inspections.
8) Requirements for obtaining samples.
9) Unique characteristics of each quality-control service.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner may engage a qualified to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 014200
REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including "shown," "noted," "scheduled," and "specified," have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated in Gale's

"Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
2. DOC - U.S. Department of Commerce; www.commerce.gov.
3. DOD - U.S. Department of Defense; www.defense.gov.
4. DOE - U.S. Department of Energy; www.energy.gov.
5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov
6. DOS - U.S. Department of State; www.state.gov.
7. EPA - United States Environmental Protection Agency; www.epa.gov.
8. FAA - Federal Aviation Administration; www.faa.gov.
9. GPO - U.S. Government Publishing Office; www.gpo.gov.
10. GSA - U.S. General Services Administration; www.gsa.gov.
11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.
12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
13. NIST - National Institute of Standards and Technology; www.nist.gov.
14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
19. USP - U.S. Pharmacopeial Convention; www.usp.org.
20. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from U.S. Government Publishing Office; www.govinfo.gov.
2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
3. DSCC - Defense Supply Center Columbus; (see FS).
4. FED-STD - Federal Standard; (see FS).
5. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
    a. Available from Defense Standardization Program; www.dsp.dla.mil.

b. Available from U.S. General Services Administration; www.gsa.gov.
c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specifications and Standards; (see DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. BEARHFTI; California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; (see BHGS).
2. BHGS; State of California Bureau of Household Goods and Services; (Formerly: California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation); www.bhgs.dca.ca.gov.
3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.oal.ca.gov/publications/ccr/.
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; https://tfsweb.tamu.edu/.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 014323
SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Special Inspections required by Authorities Having Jurisdiction including supplementary work necessary to complete inspections.

1.2 RESPONSIBILITY

A. Special Inspections do not relieve the Contractor of the responsibility to provide construction in accordance with the Contract Documents.

1.3 INSPECTOR'S RESPONSIBILITY

A. Special Inspector shall be acceptable to the Authorities Having Jurisdiction for this project.

B. Special Inspector shall be completely familiar with the Contract Documents relating to inspection responsibility.

1.4 COOPERATION

A. Contractor shall cooperate with and assist Special Inspector in performing Special Inspections. Special Inspector shall have access to the project without restriction.

1. Contractor shall advise Special Inspector in advance of construction schedules and planned operations to assure timely and appropriate observation and inspection of items requiring Special Inspections.
2. Contractor shall make available approved Shop Drawings to the Special Inspector at jobsite.

1.5 OWNER'S RESPONSIBILITY

A. Cost of employing the Special Inspector shall be the responsibility of the Owner.

B. Final interpretation of the Contract Documents shall rest with the Architect and Engineers of Record.

1.6 GENERAL DUTIES OF SPECIAL INSPECTOR

A. Special Inspector shall cooperate with the Contractor on timely observations and inspections of Work. Special Inspector shall not supervise or direct the Work.

B. Special Inspector shall immediately alert the Contractor of discrepancies and deviations from the Contract Documents and approved Shop Drawings.

C. Special Inspection Reports shall be submitted within 24 hours of the time and date of the observation and inspection.

1. Special Inspector shall submit his reports to the Authorities Having Jurisdiction for the project. In addition, Special Inspector shall submit copies of reports to the Owner and to the Contractor.
2. Upon completion of the building and prior to the issuance of a Certificate of Occupancy, a signed and sealed statement by the Special Inspector shall be submitted to the Authorities Having Jurisdiction, stating the portion of the project subject to Special Inspections has been constructed in accordance with the Contract Documents. This statement shall be provided in accordance with the governing building codes and ordinances.

1.7 SCHEDULE OF SPECIAL INSPECTIONS

A. Refer to Summary of Special Inspections.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 014339
VISUAL MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Full-size visual mockups incorporating the work of multiple sections and supplementary items necessary for installation. Single-work-result mockups are specified and described in individual sections.

1. On-Site, In-Place Mockups - Integrated Exterior Cladding: Mockups constructed on-site as part of permanent construction consisting of multiple products, assemblies, and subassemblies.
2. On-Site, Stand-Alone Mockups - Integrated Exterior Cladding: Mockups constructed on-site as freestanding temporary built elements consisting of multiple products, assemblies, and subassemblies.
3. Off-Site Mockups - Integrated Exterior Cladding: Mockups constructed off-site as freestanding temporary built elements construction consisting of multiple products, assemblies, and subassemblies.
4. On-Site, In-Place Mockups - Typical Rooms: Mockups of typical interior spaces constructed on-site as part of permanent construction complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting as indicated.
5. On-Site, Stand-Alone Mockups - Typical Rooms: Mockups of typical interior spaces constructed on-site as freestanding temporary built elements complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting as indicated.
6. Off-Site Mockups - Typical Rooms: Mockups of typical interior spaces constructed off-site as freestanding temporary built elements complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting as indicated.

B. Related Requirements:

1. Refer to Division 01 Section Laboratory Performance Mockup Testing for Building Enclosure System for off-site laboratory testing requirements.
2. Refer to Division 01 Section Field Test for Air and Water Leakage.
3. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 DELEGATED ENGINEERING REQUIREMENTS - ONSITE STAND-ALONE INTEGRATED EXTERIOR CLADDING MOCKUPS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of

the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. Include plans, elevations, sections, and mounting, attachment and support details.
2. Indicate manufacturer and model number of individual components, subassemblies, and assemblies.
3. Include site location drawing indicating orientation of mockup.
4. For integrated exterior cladding mockups, revise and resubmit Shop Drawings to reflect approved modifications in details and component interfaces resulting from changes made during testing procedures.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Integrated Exterior Cladding Mockups:

a. Review locations and extent of mockups.
b. Review Contract Document Requirements.
c. Review approved submittals.
d. Review testing procedures to be performed on mockups.
e. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and testing and maintain schedule for the Work.

3. Room Mockups:

a. Review coordination of equipment and furnishings provided by the Owner for room mockups.
b. Review locations and extent of mockups.
c. Review Contract Document Requirements.
d. Review approved submittals.
e. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and maintain schedule for the Work.

4. Record discussions, including decisions and agreements, and prepare report.

1.5 QUALITY ASSURANCE

A. Build mockups to verify compliance with the following:

1. Verify selections made under Sample submittals.
2. Demonstrate aesthetic effects and compliance with visual criteria.
3. Demonstrate the qualities of products and workmanship and compliance with Drawings, Specifications, and accepted submittals.
4. Demonstrate acceptable coordination between components and systems.

5. For integrated exterior cladding mockups, perform testing, such as window air- and water-leakage testing.

B. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.

1. Build mockups of size indicated or, if not indicated, as directed by Architect.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform the same tasks during the construction of the Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

C. Notifications:

1. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
2. Notify Architect 14 days in advance of the dates and times when mockups will be tested.

D. Approval: Obtain Architect's approval of mockups before starting fabrication or construction of corresponding Work.

1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved on-site, in-place mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate schedule for construction of mockups, so construction, testing, and review of mockups do not impact Project schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS - INTEGRATED EXTERIOR CLADDING

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Mockup Testing Performance Requirements: Perform tests using design pressures and performance criteria indicated for assemblies and products that are specified in other Sections and incorporated into integrated exterior cladding mockups.

2.2 INTEGRATED EXTERIOR CLADDING

A. General: Construct integrated exterior cladding mockups according to approved mockup Shop Drawings and as indicated on Drawings. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components,

subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.

1. Coordinate location of mockups on Project site with Owner and Architect.

B. Provide the following mockups:

1. On-Site, In-Place Mockups - Integrated Exterior Cladding: Mockups constructed on-site as part of permanent construction consisting of multiple products, assemblies, and subassemblies as indicated.
2. On-Site, Stand-Alone Mockups - Integrated Exterior Cladding: Mockups constructed on-site as freestanding temporary built elements consisting of multiple products, assemblies, and subassemblies as indicated.
3. Off-Site Mockups - Integrated Exterior Cladding: Mockups constructed off-site as freestanding temporary built elements construction consisting of multiple products, assemblies, and subassemblies as indicated.

C. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.

D. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.

E. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.

F. The Work of integrated exterior mockups includes, but is not limited to, the following:

1. Precast architectural concrete.
2. Masonry veneer.
3. Stone cladding.
4. Cold-formed metal framing and sheathing.
5. Air and weather barriers.
6. Thermal insulation.
7. Through-wall flashing.
8. Flashing and sheet metal trim.
9. Joint sealants.
10. Metal wall panels.
11. Aluminum-framed entrances and storefront.
12. Glazed framing systems.
13. Aluminum windows.
14. Glazing.
15. Wall Louvers.
16. Portland Cement Plastering.

G. Photographic Documentation: Document construction of integrated exterior mockups with photographs in accordance with Division 01 Section Photographic Documentation. Provide photographs showing details of interface of different materials and assemblies.

1. Document testing procedures, including water leakage and other deficiencies. Photograph modifications to component interfaces intended to correct deficiencies.

H. Provide and document modifications to construction details and interfaces between components and systems required to properly sequence the Work, or to pass performance testing requirements. Obtain Architect's approval for modifications.

2.3 TYPICAL ROOM

A. General: Construct room mockups according to approved mockup Shop Drawings and as indicated on Drawings to evaluate constructability, demonstrate the coordination of trades and sequencing of Work, and to demonstrate aesthetic requirements. Include each finish, component, and equipment item within room mockups; include operable lighting.

1. Build typical room mockups using installers and construction methods that will be used in completed construction.

a. Do not use special measures or techniques not representative of those to be used in the completed construction.

2. Use specified products including finishes, fixtures and details identical to those indicated and accepted by Architect for the Project. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in typical room mockups.

B. Provide the following mockups:

1. On-Site, In-Place Mockups - Typical Rooms: At the first installation of a typical module, mockups of typical interior spaces constructed on-site as part of permanent construction complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting as indicated.

a. Typical Restroom(s).
b. Classroom.
c. Patient care room.
d. Hotel guest room(s).
e. Residential apartment unit(s)
f. Assisted living apartment unit.
g. Memory care apartment unit.
h. Sports suite(s).

2. On-Site, Stand-Alone Mockups - Typical Rooms: Mockups of typical interior spaces constructed on-site as freestanding temporary built elements complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting as indicated.

a. Hotel guest room(s).
b. Sports suite(s).

3. Off-Site Mockups - Typical Rooms: Mockups of typical interior spaces constructed off-site as freestanding temporary built elements complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting as indicated.

a. Hotel guest room(s).
b. Sports suite(s).

C. The Work of room mockups includes, but is not limited to, the following:

1. Millwork and casework.
2. Lavatory countertop, complete with sealant, sink, accessories, trim, etc.
3. Doors and frames.
4. Access doors, panels and frames.
5. Door hardware.
6. Glazing.
7. Metal framing.

8. Gypsum board.
9. Ceramic tiling.
10. Acoustical ceilings.
11. Resilient flooring.
12. Wallcoverings.
13. Painting.
14. Toilet Compartment complete with partition, side wall, pilaster, door and hardware.
15. Toilet Room Accessories.
16. Registers and grilles.
17. Water closet and trim.
18. Urinal and trim.
19. Wiring devices and accessories.
20. Lighting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.2 FIELD QUALITY CONTROL

A. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

1. Refer to Division 01 Section Field Test for Air and Water Leakage for requirements.
2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing for requirements.

B. Testing and Inspections, General: Testing and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Performance Requirements: Systems shall be tested in accordance with definitions and at performance requirements, without reduction for field installation, as indicated in Technical Sections.
2. Interior Finishes: Indoor side of wall in this area shall be unfinished and left open and unobstructed, permitting full length of joints to be examined from indoor side.

   a. Do not install framing system trim and sealants prior to testing.
   b. Where testing is performed with interior construction in place, Contractor shall remove interior construction as needed to allow inspections.

3. All joints or other conditions within designated areas where leakage may occur will be tested.

   a. If operable joints such as those around doors and operable parts of windows occur within wall area involved, appropriate modifications both of procedure and performance requirements will be made in respect to such joints.

4. Correction of Deficiencies:

a. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
b. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense.
c. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

5. Prepare test and inspection reports.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 014519
FIELD TESTING FOR AIR AND WATER LEAKAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Field testing of cladding systems in accordance with performance requirements indicated, including joints in adjacent construction designed to remain permanently closed and watertight.

1. Resistance to water leakage.
2. Resistance to air leakage.

B. Owner will engage a qualified testing agency and pay costs of initial testing.

C. Contractor shall engage a qualified testing agency and pay cost of testing.

D. Contractor shall be responsible for and pay costs of remedial work and subsequent re-testing.

E. Contractor shall perform out of sequence work as required to allow testing to occur at normal intervals.

F. Related Requirements:

1. Refer to Division 01 Building Enclosure Commissioning for field observations and performance testing activities.

1.2 DEFINITIONS

A. Water Leakage: Uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces, or water that is not contained and drained to the exterior, or water that may damage adjacent materials or finishes. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

1. Uncontrolled: Infiltrated water that is not captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that wets perimeter containment system, wall insulation or exposed interior surfaces.

a. Water present within the adjacent wall system or adjacent construction assembly is considered water leakage.

2. Controlled: Infiltrated water that is captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that does not wet perimeter containment system, wall insulation or exposed interior surfaces

1.3 SUBMITTALS

A. Contractor Testing Agency Qualifications:

1. Submit qualifications for proposed Independent Testing Agency.
2. Include qualifications statement for personnel conducting and signing test reports.
3. Test Procedures: Submit testing documentation including but not limited to following:

a. Testing schedule.
b. Testing sequence including procedures and protocols.
c. Testing instrumentation and types of equipment.

4. Test Locations: Submit drawings indicating proposed test locations and designated test procedure; include plans and elevations.

B. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

1.5 CONTRACTOR RESPONSIBILITIES

A. Coordinate with Testing Agency. Provide labor, materials and equipment used for testing by testing agency personnel.

1. Contractor shall be responsible for coordinating and scheduling tests.
2. Provide powered scaffold, hose, water supply, communication system and manpower to perform tests. Schedule any work necessary, such as out of sequence sealant work, so that testing can be performed.

B. Satisfactory results of testing do not relieve Contractor from conforming to requirements of Contract Documents, shop drawings, and project specifications. Installation work on remainder of building shall match area checked, unless otherwise instructed in writing.

C. Pending actual performance, extent of or absence of water leakage in initial water penetration test, and measures adopted by the Contractor to eliminate leakage, Architect will determine need and scope of additional tests and test methods. Remedial measures are subject to approval by Architect and shall maintain standards of quality and durability.

D. Remedial measures found necessary and effective in eliminating leakage in area checked shall be used in fabricating and installing remainder of the work.

E. Notify Architect and testing agency when wall construction is ready for testing. Provide safe access for Architect and Testing Agency to interior and exterior of test locations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Refer to Technical Sections for performance requirements of each system or product to be tested.

B. Water Spray Test: Selective field testing will be conducted in accordance with AAMA Standard 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtainwalls, and Sloped Glazing Systems.

1. Water Spray Test without Air Pressure Difference: Designated areas shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.

C. Field Chamber Water Penetration Test: Selective field testing will be conducted in accordance with ASTM E 1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference - Procedure A.

1. Water Penetration Test with Static Air Pressure Difference: Designated areas shall be tested in accordance with ASTM E 1105 at a minimum static air pressure differential specified for laboratory testing in Performance Requirements and shall not evidence water penetration.

D. Field Chamber Air Leakage Test: Selective field testing will be conducted in accordance with ASTM E 783 Standard Test Method for Field measurement of Air leakage Through Installed Exterior Window and Doors.

1. Air Leakage Test with Static Air Pressure Difference: Designated areas shall be tested according to ASTM E 783 at 1.5 times the rate specified for laboratory testing in Performance Requirements Article but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a minimum static air pressure differential specified for laboratory testing in Performance Requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Exterior wall construction shall be completed and shall be fully glazed to provide complete wall installation. Work shall be done in accordance with approved shop drawings and specifications.

1. Sealants shall be fully cured as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Owner Testing Agency: Owner will employ and pay a qualified independent testing agency to perform field quality control.

B. Contractor Testing Agency: Contractor shall employ and pay a qualified independent testing agency to perform field quality control.

C. Testing and Inspections, General: Testing and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Performance Requirements: Systems shall be tested in accordance with definitions and at performance requirements, without reduction for field installation, as indicated in Technical Sections.
2. Interior Finishes: Indoor side of wall in this area shall be unfinished and left open and unobstructed, permitting full length of joints to be examined from indoor side.

a. Do not install framing system trim and sealants prior to testing.
b. Where testing is performed with interior construction in place, Contractor shall remove interior construction as needed to allow inspections.

3. All joints or other conditions within designated areas where leakage may occur will be tested.

a. If operable joints such as those around doors and operable parts of windows occur within wall area involved, appropriate modifications both of procedure and performance requirements will be made in respect to such joints.

4. Correction of Deficiencies:

a. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
b. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense.
c. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

5. Prepare test and inspection reports.

D. Architect Designated Test Procedures and Locations:

1. Field Testing shall be performed at intervals and locations including but not limited to the following:

a. Water Spray Test per AAMA 501.2: Test at intervals and locations as directed by Architect; however, not less than the following:

1) Four locations at 5% completion, four locations at 50% completion, and four locations at 90% completion.

b. Field Chamber Water Penetration Test per ASTM E 1105: Test at intervals and locations as directed by Architect; however, not less than the following:

1) Two locations at 5% completion, two locations at 50% completion, and two locations at 90% completion.

c. Field Chamber Air Leakage Test per ASTM E 783: Test at intervals and locations as directed by Architect; however, not less than the following:

1) Two locations at 10% completion, two locations at 50% completion, and two locations at 90% completion, in conjunction with Field Chamber Water Penetration Testing.

d. Perform one on more tests at locations with a re-glazed lite.

3.5 TEST REPORTS

A. Testing laboratory shall be responsible for conducting and reporting tests, state in report whether test specimen conforms to requirements of Contract Documents and approved drawings, and specifically note any deviations.

1. Include written documentation describing remedial work, including repairs and modifications required.
2. Required corrections shall be performed in presence of Architect.

B. Testing shall be witnessed by the Architect; acceptance of test assembly and test results shall be determined by the Architect.

C. Test reports shall be prepared according to testing standard indicated. Testing laboratory shall submit reports directly to Owner and Architect.

3.6 REMEDIAL WORK BY CONTRACTOR

A. In event of failure to meet test requirements, Contractor and subcontractors shall redesign, rework, and/or re-fabricate, reship and re-erect assemblies as required until test requirements are met, at no additional cost to Owner.

1. For each failed test, Contractor shall provide three additional consecutively successful test on like specimens at locations selected by the Architect.

B. Wherever leakage has occurred, joints shall be made watertight in manner acceptable to Architect.

C. Remedial work involving use of curing-type compounds shall be allowed to cure for one week minimum, but not less than manufacturer's written recommendation, before re-checking for leakage.

D. After required remedial work and curing time are completed, repaired joints shall be retested.

E. If leakage continues, additional remedial measures shall be performed; checking shall be repeated until joints in designated area are found to be acceptable.

1. Re-checking, when required, shall be performed at the Contractor’s expense by testing laboratory originally employed.

END OF SECTION

SECTION 014541
PRECONSTRUCTION LABORATORY MOCKUP TESTING FOR BUILDING ENCLOSURE SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Construction of mock-up of Building Enclosure Systems for testing and coordination with testing laboratory services employed by Owner.

1. Including but not limited to Delegated Engineering, labor, materials, and accessories indicated, specified, or required to complete installation and performance testing of exterior wall specimen (mock-up) in a laboratory.

B. Related Requirements:

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

1.2 DEFINITIONS

A. Water Leakage: Uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces, or water that is not contained and drained to the exterior, or water that may damage adjacent materials or finishes. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

1. Uncontrolled: Infiltrated water that is not captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that wets perimeter containment system, wall insulation or exposed interior surfaces.
2. Controlled: Infiltrated water that is captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that does not wet perimeter containment system, wall insulation or exposed interior surfaces

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show details of fabrication and installation. Submit mock-up Shop Drawings prior to fabrication and testing of mock-up unit.

1. Include plans, elevations, and details, including thickness of metals and glass, methods of glazing, methods of anchoring, fastening and jointing, finishes of materials, perimeter sealants and other pertinent data and information.

a. Include project specific building maintenance unit tie-back retention mechanisms.

2. Shop drawings shall contain seal of a Structural Engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
3. Final acceptance of Shop Drawings will be determined after mock-up testing and compliance with aesthetic and performance requirements.

B. As Built Mock-Up Drawings: Upon completion of testing, Contractor shall immediately provide "as built" mock-up drawings showing any modifications or additions required to meet performance requirements.

C. Test Procedures: Laboratory shall submit testing documentation including but not limited to, following:

1. Testing schedule.
2. Testing sequence including procedures and protocols.
3. Testing instrumentation and types of equipment.
4. Statement of qualifications for personnel conducting and signing test reports.

D. Test Reports.

1.5 INFORMATION SUBMITTALS

A. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Mock-up Construction Schedule: After review and approval by laboratory, contractor shall submit detailed schedule for construction of mock-up

1.6 COSTS OF TESTS

A. Cost of laboratory testing fees only (excluding set-up charges) for first series of tests shall be paid for by Owner. Cost of set-up charges, including mobilization and travel, shall be paid for by each subcontractor.

B. In the event of failures require retesting, Contractor shall pay additional laboratory fees and any fees and expenses incurred by Owner, Architect, and Consultants, as result of retesting.

C. Subcontractors shall be responsible for failure of their work to meet test requirements without adjustment to Contract Sum or Contract Schedule.

1.7 CONTRACTOR RESPONSIBILITIES

A. Satisfactory results of testing do not relieve Contractor from conforming to requirements of Contract Documents, shop drawings, and project specifications.

B. Remedial measures found necessary and effective in eliminating unacceptable test results shall be used to fabricate and install the building enclosure on the project, unless directed otherwise in writing.

C. Notify Architect and Owners Consultant a minimum of two weeks in advance of when mock-up construction begins and when mock-up will be ready for testing. Architect and Owner Consultant will observe testing.

1. No pre-testing of any kind is allowed without consent of the Architect and Owner.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

A. Mockup Construction: Contractor shall arrange for erection of test chamber at approved testing laboratory, including simulated structural supports suitable for construction of mock-ups of exterior wall construction of size and configuration indicated.

1. Build preconstruction laboratory mockups at testing agency facility using personnel, products, and methods of construction that will be used at Project site.

B. Construct full size Mock-up of typical Building Corner Unit, as shown on the Architectural Drawings, two full building stories in height, including inside and outside corners, plus their connections and supporting elements.

1. Details of the mock-up and test procedure shall be formally approved prior to the commencement of testing or the mock-up shall be deemed unacceptable.

C. Mockups shall be complete with corners, splice joints, sealants, glass and glazing, anchors, and finishes, with details complete and identical to those proposed for use in building. Do not use excessive amounts of sealant, nor other special measures or techniques not representative of those to be used in building. Finish various components to show maximum variation that will exist in actual building construction between adjacent and non-adjacent components.

1. Allow sufficient time for chemically curing sealants to achieve their proper cure as recommended by manufacturer.

D. Set up and complete installation of mock-ups at testing laboratory. Mock-ups shall be used to demonstrate quality of materials, finishes and workmanship as well as compliance with performance requirements.

1. Upon completion of satisfactory tests, dismantle mock-ups and remove from premises.

E. Testing will be performed at one of the following facilities:

1. Construction Research Laboratory, Inc. Miami, Florida.
2. Construction Consulting Laboratory, Carrollton, Texas.
3. Construction Consulting Laboratory West, Ontario, California.
4. Intertek Laboratory Testing, York, Pennsylvania.
5. Intertek Laboratory Testing, Fresno, California.
6. Smith Emery, Los Angeles, California.
7. Quast Consulting and Testing, Inc., Mosinee, Wisconsin.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mockup Installation: Install products and materials in accordance with specified requirements. Include flashings, anchors, interior trim and aluminum covers to demonstrate performance and engagement will not be affected by testing.

B. Simulate building conditions including the arrangement of structural members and anchorages that will exist within the building.

C. Glass shall be the same type and manufacturer that will be used on the project, unless approved otherwise by substitution. Provide not less than one additional lite for each type and size of glass.

1. Provide additional accessory materials including, but not limited to gaskets, removable covers and similar items so as not to delay testing should these items need to be replaced during testing.

D. Finish various components to show the maximum variation between adjacent and non-adjacent components that will exist in the actual building construction.

3.2 TESTING PROCEDURES

A. Performance Requirements:

1. **Building Enclosure Systems shall be tested in accordance with Performance Requirements, without reduction, as indicated in Technical Sections.** Variations in criteria over the surface of the building, such as wind pressure, shall be accounted for in testing mock-up.

a. Apparatus used for conducting tests shall meet requirements of each test procedure and shall be calibrated as prescribed therein.

B. Air Infiltration:

1. In accordance with ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

C. Water Penetration:

1. Static Pressure: In accordance with ASTM E331 Standard Test Method for Water penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

2. Dynamic Pressure: In accordance with AAMA 501.1 Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors using Dynamic Pressure.

D. Structural:

1. In accordance with ASTM E330/E330M Standard Test Method for Structural performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

E. Interstory Drift (Horizontal Displacement):

1. In accordance with AAMA 501.4 Recommended Static Test Method for Evaluating Window Wall, Curtain Wall and Storefront Systems Subjected to Seismic and Wind-Induced Inter-Story Drift.

F. Vertical Interstory Movement (Vertical Displacement):

1. In accordance with AAMA 501.7 Recommended Static Test Method for Evaluating Windows, Window Wall, Curtain Wall and Storefront Systems Subjected to Vertical Inter-Story Movements.

G. Thermal Cycling:

1. In accordance with AAMA 501.5 Test Method for Thermal Cycling of Exterior Walls..

3.3 TESTING

A. Preconstruction Laboratory Mockup Testing: Test preconstruction laboratory mockups according to requirements in "Performance Requirements" Article. Perform the following tests in the following order:

1. Structural: ASTM E330/E330M at 50 percent of positive test load.
2. Air Leakage: ASTM E283.
3. Water Penetration under Static Pressure: ASTM E331.
4. Water Penetration under Dynamic Pressure: AAMA 501.1.
5. Structural: ASTM E330/E330M at 100 percent of positive and negative test loads. Repeat the following:

   a. Air Leakage: ASTM E283.
   b. Water Penetration under Static Pressure: ASTM E331.
   c. Water Penetration under Dynamic Pressure: AAMA 501.1.

6. Interstory Drift (Horizontal Displacement): AAMA 501.4 at 100 percent of design displacement. Repeat the following:

   a. Air Leakage: ASTM E283.
   b. Water Penetration under Static Pressure: ASTM E331.
   c. Water Penetration under Dynamic Pressure: AAMA 501.1.

7. Vertical Interstory Movement (Vertical Displacement): AAMA 501.7. Repeat the following:

   a. Air Leakage: ASTM E283.
   b. Water Penetration under Static Pressure: ASTM E331.
   c. Water Penetration under Dynamic Pressure: AAMA 501.1.

8. Thermal Cycling: In accordance with AAMA 501.5. Repeat the following:

   a. Air Leakage: ASTM E283.
   b. Water Penetration under Static Pressure: ASTM E331.

9. Structural: ASTM E330/E330M at 100 and 150 percent of positive and negative test loads. Repeat the following:
   a. Air Leakage: ASTM E283.
   b. Water Penetration under Static Pressure: ASTM E331.
10. Concentrated Load on Building Maintenance Unit Tieback.

B. If mock-up fails to achieve acceptable performance, repair defects and deficiencies on mock-up, repeat testing and inspection until acceptable performance is achieved, and then restart test sequence beginning with test prior to failed test.

C. Re-glazing Procedure: Contractor shall demonstrate re-glazing procedure at conclusion of testing.

3.4 TEST REPORTS

A. Report for tests shall include date of test and date of report, identification of specimen (manufacturer, source or supply, dimensions, model, type, materials, and other pertinent information).

B. Testing agency shall inspect specimen and report noted deviations to mock-up shop drawings.

C. For Air Infiltration under Uniform Static Air Pressure, include:

1. Statement or tabulation of pressure difference exerted across specimen during test and corresponding rate of air leakage for each specimen tested, calculated in accordance with ASTM E 283.

D. For Water Penetration under Uniform Static Air Pressure and Dynamic Air Pressure, include:

1. Statement or tabulation of pressure difference or differences exerted across specimen and water application rates during test. For dynamic test statement of engine speed (rpm) and air stream velocity (mph).
2. Record of points of water penetration on indoor face of test specimen, and of water leakage.

E. For Structural Performance Under Uniform Static Air Pressure Difference, include:

1. Tabulation of pressure differences exerted across specimen during test and deflections and permanent deformations at locations specified for each specimen tested.
2. Duration of test loads.
3. Record of visual observations of performance.
4. When tests are made to check conformity of specimen to particular specification, identification or description of that specification.
5. Statement that tests were conducted in accordance with this method, or full description of any deviations from this method.
6. Statement as to whether or not tape or film, or both, were used to seal against air leakage, and whether in judgment of test agency, tape or film influenced results of test.
7. If several essentially identical specimens of component are tested, results for specimens shall be reported, each specimen being properly identified, particularly with respect to distinguishing features or differing adjustments. Separate drawing for each specimen will not be required if differences between them are noted on drawings provided.

F. For Structural Performance Under Vertical Displacement Resistance, include:

1. Statement or tabulation of vertical displacements applied to the specimen

2. Statement that tests were conducted in accordance with this method, or full description of any deviations from this method
3. Record of visual observations of performance documenting failures and non-compliant performance

G. For Structural Performance Under Horizontal Displacement Resistance, include:

1. Statement or tabulation of service level and design level horizontal displacements applied to the specimen
2. Statement that tests were conducted in accordance with this method, or full description of any deviations from this method
3. Record of visual observations of performance documenting failures and non-compliant performance

H. Testing laboratory shall be responsible for conducting and reporting tests, shall state in report whether test specimen conforms to requirements of Contract Documents' approved drawings, and shall specifically note any deviations therefrom.

1. Include written documentation describing remedial work, including repairs and modifications required.

I. Test reports shall be prepared according to testing standard indicated. Testing laboratory shall submit reports directly to Owner and Architect

3.5 CORRECTION OF WORK BY CONTRACTOR

A. In event of failure to initially meet test requirements called for hereinabove, Contractor and respective subcontractors shall, as required, redesign, rework, and/or refabricate, reship and re-erect and retest mock-up assemblies until said requirements are met, at no additional cost to Owner.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage, indicated by utility company meter readings, by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used, indicated by utility company meter readings, by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used, indicated by utility company meter readings, by all entities for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

C. Dust- and HVAC-Control Plan at Renovation Work: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

D. Temporary Utility Reports: Make available on request, reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

E. Implementation and Termination Schedule: Make available on request a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6 "Requirements for Demolition Operations", NECA's "Temporary Electrical Facilities," and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.

B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

D. Accessible Temporary Egress at Renovation Work: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

E. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.
5. Environmental protection regulations.
6. City ordinances and regulations.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

C. Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (42 mm) OD top rails.

D. Portable Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and

pull posts, with 1-5/8 inch (40 mm) OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.

E. Wood Enclosure Fence: Plywood, 8 feet (2.4 m) high, framed with four 2 by 4 inch (50 by 100 mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.

F. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mil (0.25 mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

G. Polyethylene Sheet: Reinforced, fire-resistive sheet, 6 mil (0.14 mm) minimum thickness, with Class A flame-spread rating per ASTM E 84 and passing NFPA 701 Test Method 2.

1. Basis of Design (Product Standard): Abatement Technologies, Inc.; SAFE-FLEX ICRA Awareness Barrier.

H. Dust Containment Barrier for Doors: reinforced, fire-resistive polyethylene sheet, 10 mil (0.25 mm) minimum thickness with Class B flame-spread rating per ASTM E 84 and designed to be used for securing temporary construction doors so as to minimize and mitigate particle control during construction.

1. Basis of Design (Product Standard): Abatement Technologies, Inc.; Aire Guardian Door Guard Reusable Barrier.

I. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (900 by 1500 mm).

J. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site.
2. Conference room of sufficient size to accommodate. Provide electrical power service and 120-V ac duplex receptacles. Furnish room with conference table, chairs, and tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor.
5. Lighting fixtures capable of maintaining average illumination at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

D. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

E. Air-Filtration Units for Renovation Work: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. Locate temporary utilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify utilities as required.

B. Provide each utility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until utilities are no longer needed or are replaced by authorized use of completed permanent utilities.

C. Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

D. Storm Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
2. Connect temporary sewers to municipal system as directed by sewer department officials.
3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.

E. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Sterilize temporary water piping before use in accordance with requirements of authorities having jurisdiction.

F. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Existing Toilets in Occupied Facilities: Use of Owner's existing toilet facilities will not be permitted or allowed.

G. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

H. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

   a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
   b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

I. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

L. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Provide telephone line(s) for each field office.

M. Electronic Communication Service: Provide internet access of not less than 15-Mbps download and 5-Mbps upload speed for use by Architect and Owner to access Project electronic documents and maintain electronic communications

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Provide dust-control that is nonpolluting and nontracking. Reapply as required to minimize dust.

C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Coordinated parking with Owner’s requirements.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar construction is completed.
3. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Coordinated signs with Owner’s requirements and requirements of authorities having jurisdiction.

G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

H. Comply with progress cleaning requirements in Division 01 Section "Execution."

I. Existing Elevator Use in Occupied Facilities: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators

become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

J. Existing Stair Usage in Occupied Facilities: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 01 Section "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

J. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.

K. Temporary Enclosures: Provide temporary, weathertight, enclosures for protection of construction, in progress and completed, including, but not limited to, vertical and horizontal openings, from exposure, foul weather, other construction operations, and similar activities.

L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (450 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

   a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1200 mm) between doors. Maintain walk-off mats in vestibule, for dust control.

3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241 and authorities having jurisdiction; manage fire-prevention program.

3.5 MOISTURE CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of discoloration that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.

6. Discard, replace, or clean stored or installed material that begins to show discoloration.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits. Refer to technical specification sections for additional and more stringent criteria.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, and equipment from those required by the Contract Documents and proposed by Contractor. Refer to Division 01 Section “Substitution Procedures”.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "Product Standard," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers

D. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.

E. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at the time Contractor’s services are rendered, any amendments for Contractor’s services rendered after the effective date of any such amendments.

1.3 SUBMITTALS

A. Comparable Products: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

C. Contractor Affidavit: Submit an affidavit on construction company letterhead signed by an officer of the company, notarized by a notary public, which certifies compliance with the environmental laws controlling hazardous substances for the construction of this Project.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Compliance: Contractor shall take whatever measures deemed necessary to insure that all employees, suppliers, vendors, fabricators, subcontractors, or their assigns, to comply with hazardous substance requirements.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product, required by the Contract Documents to provide specific rights for Owner, and specifically endorsed by manufacturer to Owner.
2. Warranties: Prepare a written document, on manufacturer’s standard form, modified to include Project-specific information, that contains appropriate terms and identification, properly executed.

B. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Products and materials brought onto the Project Site, and products and materials incorporated into the Work, shall comply with environmental laws.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

   a. Restricted List (Acceptable Manufacturers/Fabricators and Products): Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
   b. Nonrestricted List (Available Manufacturers/Fabricators and Products): Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

   a. Restricted List (Acceptable Manufacturers/Fabricators): Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
   b. Nonrestricted List (Available Manufacturers/Fabricators): Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies

with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product (Product Standard): Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers, or unnamed manufacturer's product.

C. Descriptive Specification Requirements: Where Specifications describe a product, or assembly, listing exact characteristics required, without use of a brand or trade name, provide a product, material or assembly that provides the characteristics and otherwise complies with Contract requirements.

D. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product or material is specified for a specific application.

1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

E. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.

F. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

G. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's color, gloss, pattern, density, or texture" or similar phrase, select a product (and manufacturer) that complies with other specified requirements.

1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
2. Custom Range: Where Specifications include the phrase "custom range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
3. Special Custom Range: Where Specifications include the phrase “special custom range of colors patterns, textures” or similar phrase, Architect will select a new color, pattern, or texture different from those normally produced by the manufacturer.

H. Allowances (If Applicable): Refer to provisions of individual Specification Sections and of Division 01 Section "Allowance" for allowances that control product selection and for procedures required for processing such selections.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied,

Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents; that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION

3.1 RESTRICTION OF HAZARDOUS SUBSTANCES

A. Contractor agrees that it shall not knowingly after reasonable diligence and effort, incorporate into the Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Contractor shall not cause any release of hazardous substances into, or contamination of, the environment, including soil, the atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Contractor engages in any of the activities prohibited in this paragraph, to the fullest extent permitted by law, Contractor hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.

B. In the event Contractor observes on the Project Site any substance which Contractor reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on the Project Site, in a manner violative of any applicable environmental laws, Contractor shall immediately notify Owner and report the condition to Owner in writing. The Work in the affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Contractor fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at the Project Site, to the fullest extent permitted by the law, Contractor hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Contractor's failure to stop the Work.

C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about the Project Site by Contractor or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of the Project Site conducted as it deems appropriate, and Contractor shall be responsible for the cost of such studies to the extent that Contractor or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 017300
EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 SUBMITTALS

A. Land Surveyor Qualification Data: For land surveyor or professional engineer.

B. Land Surveyor Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

   a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

D. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.

E. Final Property Survey: Submit 6 copies showing the Work performed and record survey data.

F. Retention System Certification: Submit a statement certified by the Contractor's registered structural engineer that the design of components of the excavation support system is in compliance with provisions of the Contract Documents and the local building code, and is in keeping with generally accepted engineering practice.

1. Submit, if requested, design calculations, specifications and erection drawings, bearing the Contractor's registered structural engineer's stamp, to the local building code official.
2. Submit complete excavation support system shop drawings for information coordination purposes only.
3. Architect/Engineer will neither review nor approve excavation support system shop drawings.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor or engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Retention System Engineering: Each component of the excavation support system shall be designed by a registered structural engineer, in accordance with the local building code, and registered structural engineer shall be engaged by the Contractor.

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Miscellaneous Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

a. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

D. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

E. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.5 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable construction requirements Section.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

C. Existing Utility Interruptions at Renovation Work: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

D. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

E. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

F. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.4 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.5 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: 30 days after completion of each work component/activity, including, but not limited to, foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.6 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated, unless indicated otherwise in the Contract Documents.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located, aligned, and coordinated with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.7 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
    b. Patch fire rated assemblies with materials to match existing and maintain assembly fire rating.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.8 OWNER-INSTALLED PRODUCTS

A. Site Access: As applicable, provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.9 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    a. Use containers specifically intended for holding types of waste materials indentified where applicable, e.g. blue colored containers with labeling and symbols for bio-waste.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills immediately.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal", whichever is the more restrictive.

H. Remove construction markings not required and graffiti immediately, repairing or replacing damaged material.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.10 STARTING AND ADJUSTING

A. As applicable, coordinate startup and adjusting of equipment and operating components with commissioning requirements in Division 01 specification sections.

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.11 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 017419.13
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.

D. Diversion: Avoidance of demolition and construction waste sent to landfill or incineration. Diversion does not include using materials for landfill, alternate daily cover on landfills, or materials used as fuel in waste energy processes.

E. Material Stream: A flow of materials coming from a job site into markets for building materials. Examples of material streams include deconstructed materials sent to reuse markets, commingled waste sent to mixed-waste recycling facility, source separation where each material is sent to a specific facility, manufacturers' or suppliers' take-back of materials, and reuse of deconstructed materials on-site.

F. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

G. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

H. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

I. Source Separation: The act of keeping different types of waste materials separated starting at the first instance a material is considered waste.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

1.4 SUBMITTALS

A. Waste Management Plan: Submit plan within 14 days of date established for commencement of the Work.

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons (tonnes).
4. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
5. Quantity of waste recycled, both estimated and actual in tons (tonnes).
6. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Qualification Data: For waste management coordinator and refrigerant recovery technician.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements.

B. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.6 WASTE MANAGEMENT PLAN

A. General: Develop and implement a Construction Waste Management Plan (CWMP) consisting of waste identification, waste reduction work plan, waste diversion goal, whether separated or comingled and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume but use the same units of measure throughout the CWMP.

B. Waste Identification: Indicate anticipated types and quantities of waste generated by the Work. Include estimated quantities and assumptions for estimates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials for the following.

1. Demolition Waste:

a. Landscape Debris and Soil: Do not include as part of demolition waste quantities.

2. Construction Waste:

a. Divert 50% by weight or higher when mandated by local ordinance.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Division 1 Section "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

1. Periodic Observations: Contractor’s qualified waste management coordinator shall periodically inspect waste collection bins to ensure collection is proceeding in accordance with requirements.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned.
2. Distribute waste management plan to entities when they begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, or sold.
2. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Not allowed unless noted otherwise.
2. Clean, repair, service, and refinish salvaged items, unless noted otherwise.
3. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
4. Store items in a secure area until installation.
5. Protect items from damage during transport and storage.
6. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 RECYCLING WASTE, GENERAL

A. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

A. General: Grind, chip, separate, sort, stack and store as necessary to process waste material.

3.5 RECYCLING CONSTRUCTION WASTE

A. General: Grind, crush, remove reinforcing and metals, separate, sort, stack and store as necessary to process waste materials

B. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

C. Wood Materials:

1. Lumber Treated with Heavy-Metal Preservatives: Do not grind, chip, or incinerate; must be reused or landfilled.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

D. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 017700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

1.2 SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

C. Certificates of Release: From authorities having jurisdiction.

D. Certificate of Insurance: For continuing coverage.

E. Field Report: For pest control inspection.

F. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.3 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item

and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.

5. Submit test/adjust/balance records.

C. Procedures Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request, in writing, reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

E. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

1.4 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list). Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.

Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in the format agreed upon by the Owner and Architect.

1.6 PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within minimum number days, as required by the Contract, of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations, as applicable, before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
   k. Remove labels that are not permanent.
   l. Remove all graffiti and construction writing.
   m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
   q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
   r. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal", whichever is the more restrictive and as follows:

1. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace all lamps and starters to comply with requirements for new fixtures.

C. All Warranties remain in effect.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 017823
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Owner.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.

2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 017839
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project as constructed record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned record.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit-annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

A. Electronic File of Project Record Documents: Provide Architect with an independent electronic archive of accepted project record documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination", in addition to the printed documents described elsewhere in this Section.

2.2 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.3 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.4 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.5 MISCELLANEOUS RECORDS

A. Assemble miscellaneous records submittals required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 017846.13
EXTRA STOCK AND MAINTENANCE MATERIALS - ARCHITECTURAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Extra stock and maintenance material requirements for contract closeout.

1.2 SUBMITTALS

A. Extra Stock and Maintenance Materials: Furnish maintenance materials, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number.

1. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner’s signature for receipt of submittals.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store materials in containers and packaging as recommended by manufacturer.

PART 2 - PRODUCTS

2.1 SCHEDULE OF EXTRA STOCK AND MAINTENANCE MATERIALS

A. A Schedule of Materials is attached to this Section.

2.2 SCHEDULE OF EXTRA STOCK AND MAINTENANCE MATERIALS

A. 04 4200 - Exterior Stone Cladding:

1. Stone Cladding Units: 2%; amount installed, full-size units, each shape and thickness.

B. 07 2400 - EIFS:

1. Maintenance Kit: Consisting of the following items:

a. Printed Maintenance Instructions.
b. Adhesive: 1 gallon (3.8 L).
c. Base Coat Material: 1 gallon (3.8 L).
d. Finish Coat Material: 1 gallon (3.8 L), each color, from same batch as installed finish coat.
e. Reinforcing Mesh: 20 sf (1.8 sq m).
f. Insulation Board: 20 sf (1.8 sq m).

C. 07 3113 - Asphalt Shingles:

1. Asphalt Shingles: 100 sq. ft. (9.3 sq. m), unbroken bundles, each type, composition, color, pattern, and size.

D. 07 3127 - Simulated Slate Roofing:

1. Simulated Slate Roofing: 100 sq. ft. (9.3 sq. m), unbroken bundles, each type. Components from same production run as materials installed.

E. 07 3200 - Roof Tiles:

1. Roof Tiles and Accessories: 2%; amount installed, each type, composition, color, pattern, and size. Components from same production run as materials installed.

F. 07 4646 - Fiber Cement Siding:

1. Fiber Cement Materials and Accessories: 2%; amount installed, full size units, each type.

G. 07 7600 - Roof Pavers and Pedestals:

1. Roof Pavers and Pedestals: 2%; amount installed, each type, composition, color, pattern, and size. Components from same production run as materials installed.

H. 08 4400 - Glazed Aluminum Framing Systems:

1. Glass: 1%; total square footage installed, each glass type in sizes determined by the Architect.
2. Entrance Door Hardware: 3 sets; operating hardware.
3. Glazing Gaskets: 500 LF; typical glazing gaskets.
4. Finish Coating: 2 gallons; each architectural metal finish coating system and color.

I. 08 7100 - Door Hardware:

1. Locksets: To be determined.
2. Closers: To be determined.
3. Exit Devices: To be determined.
4. Electrical Parts: To be determined.
5. Guestroom Locksets: 3 per 100; guestroom locksets only.
6. Maintenance Tools and Instructions: 1 complete set, specialized tools and maintenance instructions.

J. 09 3000 - Tiling:

1. Tile and Trim: 2%, amount installed, each type, composition, color, pattern, and size.
2. Grout: 2%, amount installed, each type, composition, and color.

K. 09 5113 - Acoustical Panel Ceilings:

1. Ceiling Panels: 2%; amount installed, full size units.
2. Suspension System Components: 2%, amount installed, each grid, exposed molding and trim component.
3. Hold Down Clips: 2%; amount installed.
4. Impact Clips: 2%; amount installed.

L. 09 5135 - Snap-In Metal Pan Ceilings:

1. Metal Pans: 1%, amount installed, full-size units.
2. Suspension System Components: 1%, amount installed, each grid and exposed molding and trim component.

M. 09 5423 - Linear Metal Ceilings:

1. Ceiling Components: 1%, amount installed, each pan, carrier, accessory, and exposed molding and trim.

N. 09 5436 - Suspended Decorative Grids:

1. Suspension System Components: 1%, amount installed, each component.

O. 09 6340 - Stone Flooring:

1. Stone Flooring and Trim: 2%, amount installed, each type, composition, color, pattern, and size.
2. Grout: 2%, amount installed, each type, composition, and color.

P. 09 6400 - Wood Flooring:

1. Wood Flooring: 1%, amount installed, each type, color, and finish.

Q. 09 6500 - Resilient Flooring:

1. Resilient Tile Flooring: 1 box for each 50 boxes of amount installed, each type, color, pattern, class, wearing surface, and size.
2. Resilient Sheet Flooring: 10 linear ft (3 linear m) in roll form and full roll width for each 500 linear ft (150 linear m) of amount installed, each color, pattern, and type.

R. 09 6513 - Resilient Base and Accessories:

1. Resilient Base: 10 linear ft (3 linear m) for each 500 linear ft (150 linear m) of amount installed, each type, color, pattern, and size.

S. 09 6520 - Interlocking Rubber Tile Flooring:

1. Rubber Tile: 5%, amount installed, each type, color, pattern, and size.

T. 09 6566 - Resilient Athletic Flooring:

1. Resilient Athletic Flooring: 2%; amount installed, each type, color, pattern, class, wearing surface, and size.

U. 09 6800 - Carpeting:

1. Tile Carpeting: 5%, amount installed but not less than 10 SY; amount installed, full-size units, each color and type.
2. Sheet Carpeting: 10 linear ft (3 linear m) in roll form and full roll width, for each 500 linear ft (150 linear m) amount installed, each color, pattern, and type.
3. Carpet Cushion: 10 linear ft (3 linear m) in roll form and full roll width, for each 500 linear ft (150 linear m) amount installed, each type.

V. 09 6900 - Access Flooring:

1. Access Flooring Panel Type 1 - Typical Areas: 25 panels.
2. Access Flooring Panel Type 2 - Data Areas: 10 panels.
3. Access Flooring Panel Type 3 - MRI-related Areas: 10 panels.
4. Pedestals: 10 units.
5. Stringers: 10 units.
6. Grommets: 10 units
7. Fasteners: As required for each extra component.
8. Adhesive: One case.

W. 09 7200 - Wall Covering:

1. Wall Covering: 5%; amount installed, full-size units, each type.

X. 09 7723 - Fabric Wrapped Panels:

1. Fabric: 10%, amount installed but not less than 10 yds, each fabric, color, and pattern.
2. Attachment Devices: 5%, amount installed but not less than five full-size units.

Y. 09 8433 - Acoustical Wall Panels:

1. Wall Panels: 2%; amount installed, full-size units, each type.

Z. 09 9100 - Painting:

1. Painting: 5%, amount installed but not less than 1 gallon; each material and color.

AA. 09 9413 - Textured Interior Coatings:

1. Textured Interior Coatings: 5%, amount installed but not less than 1 gallon; each material and color.

BB. 09 9600 - High Performance Coatings:

1. Refer to Division 9 section High Performance Coatings for requirements.

CC. 09 9613 - Multi-Colored Interior Coatings:

1. Coatings: 5%, amount installed but not less than 1 gallon; each material, color and pattern.

DD. 09 9623 - Graffiti Resistant Coatings:

1. Graffiti Resistant Coatings: 5%, amount installed but not less than 5 gallons; each material and color.

EE. 09 9653 - Elastomeric Coatings:

1. Elastomeric Coatings: 5%, amount installed but not less than 1 gallon, each color

FF. 09 9663 - Textured Acrylic Coatings:

1. Textured Acrylic Coatings: 5%, amount installed but not less than 1 gallon, each color.

GG. 10 2115 - Cubicle Specialties:

1. Curtain Carriers and Track End Caps: 3%, amount installed but not less than 10 units, full-size units, each size.
2. Curtains: 10%, amount installed but not less than 2 units, full-size units.

HH. 10 2238 - Operable Panel Partitions:

1. Refer to Division 10 section Operable Panel Partitions for requirements.

II. 10 2613 - Wall and Corner Guards:

1. Wall and Corner Guards: 2%, amount installed but not less than 2 units, full-size units of maximum length, including plastic cover and aluminum retainer, each type and color. Components from same production run as materials installed.

JJ. 10 5116 - Wood Lockers:

1. Locker Doors: 2 doors, full-size units, each type and color, complete with door hardware.
2. Locker Hardware: 5%, amount installed but not less 2 each of hinges, pulls, hooks, and locks, each type and finish.

KK. 10 5503 - USPS-Delivery Postal Specialties

1. Key Blanks: 25 for each type of compartment-door lock.

LL. 12 2113 - Horizontal Louvered Blinds:

1. Horizontal Louvered Blinds: 5%, amount installed but not less than 2 units, each size, color, texture, pattern, and gloss.

MM. 12 2413 - Roller Window Shades:

1. Roller Window Shades: 5%, amount installed but not less than 2 units; full-size units, each size, color, texture, and pattern.

NN. 12 6300 - Stadium Seating:

1. Refer to Division 12 section Stadium Seating for requirements.

OO. 32 1813 - Synthetic Grass Field Turf:

1. Refer to Division 32 section Synthetic Grass Field Turf for requirements.

PP. 32 1826 - Synthetic Grass Turf:

1. Refer to Division 32 section Synthetic Grass Turf for requirements.

QQ. FF&E:

1. FF&E: All remaining decorative, FF&E unused material.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 017910

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.2 SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator instructor videographer.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

E. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Date of video recording.

2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc or digital video disk.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.
b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:

a. Emergency manuals.
b. Operations manuals.
c. Maintenance manuals.

d. Project record documents.
e. Identification systems.
f. Warranties and bonds.
g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.

e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide video resolution as requested by Owner converted to .mp4 format file type, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following

for each Contractor involved on the Project, arranged according to Project table of contents:

a. Name of Contractor/Installer.
b. Business address.
c. Business phone number.
d. Point of contact.
e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

a. Produce segments to present a single significant piece of equipment per segment.
b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 018112.13
HEALTH AND ENVIRONMENTAL PERFORMANCE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements and procedures for health and environmental performance requirements.

1.2 DEFINITIONS

A. Bio-based Materials: Bio-based products and materials other than wood must be tested using ASTM Test Method D6866 or equivalent method ISO 16620-2, or be certified to the USDA BioPreferred Voluntary Labeling Initiative that includes verification via ASTM 6866 testing. Exclude hide products, such as leather and other animal skin material.

B. CDPH Standard Method: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.1-2010 o newer, for the emissions testing and requirements of products and materials

C. Composite Wood and Agrifiber: Products such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores that are a composite of wood and/or plant material pressed and adhered together.

D. Cradle to Gate Assessment: Analysis of a product's partial life cycle, from resource extraction (cradle) to the factory gate (before it is transported for distribution and sale). It omits the use and the disposal phases of the product.

E. Cradle to Grave: Analysis of a product's full life cycle, from resource extraction (cradle) to the disposal phase (grave).

F. Cradle to Cradle Certification: End use product has been certified by the Cradle to Cradle Product Innovation Institute

G. Declare Label: International Living Future Institute, Declare Product Label indicating all ingredients have been evaluated and disclosed down to 1000 ppm.

H. Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and peer-reviewed.

1. Product-Specific Declarations: A product with a publicly available, critically reviewed life-cycled assessment conforming to ISO 14044 that has at least a cradle to gate scope.
2. Industry-Wide (Generic) EPD: Provide products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. EPD must conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
3. Product Specific Type III EPD: A product with a third-party certification, including external verification, in which the manufacturer is explicitly recognized by the program operator. EPD must conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

I. GBCI: Green Business Certification Institute; the Certification body that oversees LEED and WELL Certifications.

J. GWP: Global Warming Potential; the heat absorbed by any greenhouse gas in the atmosphere typically reported in carbon dioxide equivalent.

K. Health Product Declaration (HPD): End use product has published a complete Health Product Declaration in compliance with the Health Product Declaration Open Standard and with a chemical inventory of the product to at least 1000 ppm or to at least 100 ppm with no known GreenScreen v1.2 Benchmark Level 1 Chemicals.

L. Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 2nd edition, 2007, ANSI/SMACNA 008“2008, Chapter 3.

M. Inside the Building: Defined as inside the weatherproofing system.

N. Life Cycle Assessment: An evaluation of the environmental effects of a product from cradle to grave, as defined by ISO 14040-2006 and ISO 14044-2006.

O. Mindful Materials: a design industry initiative that provides a common platform for manufacturers to clearly communicate transparency and optimization information for their building products. www.mindfulmaterials.com

P. Product: A permanently installed building product is an item that arrives on the project site either as a finished element ready for installation or as a component to another item assembled on-site. The product unit is defined by the functional requirement for use in the project; this includes the physical components and services needed to serve the intended function of the permanently installed building product. In addition, similar product within a specification, each contributes as a separate product.

Q. Product Category Rules: A set of rules, requirements, and guidelines for developing Environmental Product Declarations.

R. Program Operator: An organization that ensures EPDs meet the product category rules (PCRs) for the associated product category. The program operator doesn’t do the actual life-cycle assessments. UL Environment is the leading program operator in the United States.

S. Volatile Organic Compound (VOC): Carbon compounds considered indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and wellbeing of installers and occupants. VOC content measurements are available for wet-applied products.

T. Volatile Organic Compounds (VOC) Emissions Test: Refer to CDPH Standard Method definition.

U. Wet Applied Products: Materials and products installed in wet form that have South Coast Air Quality Management District (SCAQMD) rules relating to VOC associated with them. These include the following:

1. SCAQMD Rule 1113: Architectural Coatings
2. SCAQMD Rule 1168: Adhesive and Sealant Applications

1.3 PRECONSTRUCTION AND COORDINATION MEETINGS

A. Preconstruction Conference: Conduct conference with Owner and Architect at a mutually agreed upon time within 21 days prior to commencement of the Work.

1. Participants:

a. Owner.
b. Owner's Commissioning Agent.
c. Architect.
d. Architect's Consultants.
e. Contractor, including superintendent.
f. Contractor's Major Subcontractors
g. If requested, other concerned parties needed to conduct the conference.

2. Minimum Agenda: Include, but not be limited to, following topics:

a. Review Health and Environmental Performance requirements and Contractor's Action Plans for meeting requirements.
b. Submittal requirements and approval sequence.
c. Review Contract Document requirements.
d. Review inspection and testing requirements.

3. Record discussions, including decisions and agreements, and prepare report.

B. Coordination Meetings: Conduct meetings with Owner and Architect at a mutually agreed upon times.

1. Requirements: Participants, minimum agenda and meeting minutes similar to preconstruction conference.

1.4 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Work Includes: Provide materials and procedures necessary to obtain health and environmental performance goals required in this Section.

1. Refer to other sections for additional materials and procedures necessary to obtain sustainable design goals.

1.5 SUBMITTALS

A. Health and Environment Performance Requirements Documentation:

1. Construction and Demolition Waste Management: Comply with plan requirements of Division 1 Section "Construction Waste Management and Disposal."
2. Construction Indoor-Air-Quality (IAQ) Management Plan:

a. Construction IAQ Management Plan developed in accordance with Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, Version indicated.
b. Product data for temporary filtration media.

1) Provide minimum MERV 8 filtration when mechanical system is used during construction.

c. Product data for filtration media used during occupancy.
d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
e. Prohibit smoking inside the building and within 25 feet of the building openings during construction. Smoking includes tobacco smoke, as well as smoke produced from the combustion of cannabis and controlled substances and the emissions produced by electronic smoking devices.

3. Mindful Materials Plan:

a. Identify at least 25 products that will be used in this project that meet the identified Mindful Materials transparency or optimization documentation.
b. Include certifications and optimization data by manufacturer that products supplied comply with the identified Mindful Material transparency or optimization documentation.

B. Product Data: Manufacturer's technical literature for interior applied adhesives, sealants, paints and coatings indicating VOC content in grams/Liter (g/L).

1. |Include Certifications by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and General Emissions Requirements indicated in this Section

C. Health and Environmental Performance Requirements Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with Health and Environmental Performance action plans.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide products and procedures necessary. The Contractor shall provide additional materials and procedures necessary to obtain performance requirements indicated.

1. Exclusions: Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from the credit calculations. Also excluded are products purchased for temporary use on the project, e.g. formwork for concrete.

2.2 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION

A. Provide submittals that ensure 25 different products that comply with Mindful Materials Material Ingredient Disclosure or Environmental Profile requirements.

B. Material Ingredient Disclosure

1. Comply with any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm), which meet one of the following disclosure criteria

a. Cradle to Cradle (C2C) certifications, version 3 bronze or above
b. Cradle to Cradle Material Health Certificate
c. Declare Product Labels
d. HPD
e. Living Product Challenge

C. Environmental Profile

1. Environmental Product Declaration

a. Product specific Type III EPD, must meet the following standards
b. ISO 14025
c. ISO 21930 or EN 15804
d. EPD must be at least Cradle-to-Gate Scope

2.3 TOXIC MATERIAL REDUCTION

A. General: the following limitations apply to materials installed within the weather-proofing membrane of the Project.

B. Antimicrobials

1. No antimicrobials are present that make a health claim.

C. Bisphenol A (BPA).

1. No product that contains Bisphenol A.

D. Cadmium

1. Use no interior or exterior paints containing intentionally added cadmium.
2. Cadmium is limited in the following components to 0.01% (100 ppm):

a. Fire alarms
b. Electrical meters
c. Electrical sensors
d. Thermostats
e. Load breaker switches

E. Perfluorinated Compound Limitation

1. No perfluorinated compounds (PFCs) are present in the following condition:

a. At levels equal to or greater than 100 ppm in components that constitute at least 5% by weight of a furniture or furnishing (drapes/curtains) assembly.

F. Flame Retardant Limitation

1. Halogenated flame retardants are limited in the following components to 0.01% (100 ppm) to the extent allowable by local code:

a. Window and waterproofing membranes, door and window frames and siding.
b. Flooring, ceiling tiles and wall coverings.
c. Piping and electrical cables, conduits and junction boxes.
d. Sound and thermal insulation.
e. Upholstered furniture and furnishings, textiles and fabrics.

G. Phthalate (Plasticizers) Limitation

1. DEHP, DBP, BBP, DINP, DIDP or DNOP (often found in polyvinyl chloride [PVC]) are limited in the following components to 0.01% (100 ppm):

a. Flooring, including resilient and hard surface flooring and carpet.
b. Wall coverings, window blinds and shades, shower curtains, furniture and upholstery.
c. Plumbing pipes and moisture barriers.

H. Isocyanate-Based Polyurethane Limitation

1. Isocyanate-based polyurethane products are not used in:

a. Interior finishes.

I. Urea-Formaldehyde Restriction

1. Urea-formaldehyde is limited in the following components to 100 ppm:

a. Furniture or any composite wood products.
b. Laminating adhesives and resins.
c. Thermal insulation.

2.4 LOW-EMITTING MATERIALS

A. Refer to Division 01 Section Construction Requirements for VOCs.

2.5 VOLATILE ORGANIC COMPOUND (VOCs) LIMITS

A. General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method, version indicated, using the applicable exposure scenario. Manufacturers documentation demonstrating compliance must state the range of Total VOCs (TVOC) after 14 days measured as specified in the CDPH Standard Method CATEGORIES as follows:

1. 0.5mg/m3 or less,
2. Between 0.5 and 5.0 mg/m3 or,
3. 5.0 mg/m3 or more.

2.6 PAINTS AND COATINGS

A. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits.

1. South Coast Air Quality Management District (SCAQMD): Use only paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 5, 2016.
2. California Department of Public Health (CDPH): Compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", version indicated.

   a. At least 75 percent of paints and coatings.

2.7 ADHESIVES AND SEALANTS

A. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits.

1. South Coast Air Quality Management District (SCAQMD): For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on October 6, 2017.

   a. Exception: The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.

2. California Department of Public Health (CDPH): For field applications that are inside the weatherproofing system, compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers", version indicated.

   a. At least 75 percent of adhesives and sealants (by volume or surface area).

B. Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

1. At least 75 percent of flooring (by cost or surface area).

C. Composite Wood: Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde (NAF).

1. At least 75 percent of composite wood (by cost or surface area).

D. Insulation: Insulation inside the weatherproofing membrane shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The insulation material category includes all thermal and acoustic boards, batts, rolls, blankets, sound attention fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation.

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

A. Smoking of any kind is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, outdoor-air intakes, decks, patios, balconies, rooftops and other regularly occupied exterior building spaces. Applicable during construction.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Comply with Division 1 Section "Construction Waste Management and Disposal."

3.3 CONSTRUCTION IAQ MANAGEMENT

A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."

3.4 COMBUSTION MINIMIZATION

A. Engine Exhaust Reduction:

1. Signage, visible from pick-up, drop-off and parking areas indicates:

a. Idling with vehicle engines on for more than 30 seconds is prohibited.

B. Construction Equipment:

1. To reduce particulate matter emissions from both on-road and non-road diesel fueled vehicles and construction equipment, the following requirements are met:

a. All non-road diesel engine vehicles comply with the U.S. EPA Tier 4 PM emissions standards or local equivalent when applicable. Engines may be retrofitted with verified technology (required to be U.S. EPA or California Air Resources Board approved) at the time the equipment is first placed on the job site.
b. All on-road diesel engine vehicles meet the requirements set forth in the U.S. EPA model year 2007 on-road standards for PM, or local equivalent when applicable. Engines may be retrofitted with verified technology (required to be U.S. EPA or California Air Resources Board approved) at the time the equipment is first placed on the job site.
c. All equipment, vehicles and loading/unloading are located at least 25 ft. (7.5 m) away from air intakes and operable openings.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 018116.16
CONSTRUCTION REQUIREMENTS FOR VOCs

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Volatile Organic Compound (VOC) limits for adhesives, sealants, paints and coatings.

B. Related Sections:

1. Refer to Division 01 Section for Health and Environmental Performance Requirements.

1.2 DEFINITIONS

A. CDPH Standard Method: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.1-2010 or current version, for the emissions testing and requirements of products and materials.

B. Volatile Organic Compounds (VOC) Emissions Test: Refer to CDPH Standard Method v1.1 definition.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for interior applied adhesives, sealants, paints and coatings indicating VOC content in grams/Liter (g/L).

1. Include Certifications by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and General Emissions Requirements indicated in this Section.

PART 2 - PRODUCTS

2.1 VOLATILE ORGANIC COMPOUND (VOCs) LIMITS

A. General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method, version indicated, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of Total VOCs (TVOC) after 14 days measured as specified in the CDPH Standard Method CATEGORIES as follows:

1. 0.5mg/m3 or less,
2. Between 0.5 and 5.0 mg/m3 or,
3. 5.0 mg/m3 or more.

2.2 PAINTS AND COATINGS

A. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits

1. Air Quality Resources and Management: Use only paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.
2.

Product Type	Allowable VOC Content (g/L)
Bond Breaker	350
Clear wood finishes - Varnish	275
Clear wood finishes - Sanding Sealer	275
Clear wood finishes - Lacquer	275
Colorant - Architectural Coatings, excluding IM coatings	50
Colorant - Solvent Based IM	600
Colorant - Waterborne IM	50
Concrete - Curing compounds	100
Concrete - Curing compounds for roadways & bridges	350
Concrete surface retarder	50
Driveway Sealer	50
Dry-fog coatings	50
Faux finishing coatings - Clear topcoat	100
Faux finishing coatings - Decorative Coatings	350
Faux finishing coatings - Glazes	350
Faux finishing coatings - Japan	350
Faux finishing coatings - Trowel applied coatings	50
Fire-proof coatings	150
Flats	50
Floor coatings	50
Form release compounds	100
Graphic arts (sign) coatings	150
Industrial maintenance coatings	100
Industrial maintenance coatings - High temperature IM coatings	420
Industrial maintenance coatings - Non-sacrificial anti-graffiti coatings	100
Industrial maintenance coatings - Zinc rich IM primers	100
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-color coatings	250
Non-flat coatings	50
Pre-treatment wash primers	420
Primers, sealers and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	150
Roof coatings	50
Roof coatings, aluminum	100
Roof primers, bituminous	350
Rust preventative coatings	100
Stone consolidant	450
Sacrificial anti-graffiti coatings	50
Shellac- Clear	730
Shellac - Pigmented	550

Specialty primers	100
Stains	100
Stains, interior	250
Swimming pool coatings - repair	340
Swimming pool coatings - other	340
Traffic Coatings	100
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100
Wood preservatives	350
Low solids coatings	120

2.3 ADHESIVES AND SEALANTS

A. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Air Quality and Resources Management: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on October 6, 2017:

2.

Architectural Applications	Allowable VOC Content (g/L)
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Dry wall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single ply roof membrane adhesives	250
Specialty Applications:	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Computer diskette manufacturing	350
Contact adhesive	80
Special purpose contact adhesive	250
Tire retread	100
Adhesive primer for traffic marking tape	150
Structural wood member adhesive	140
Sheet applied rubber lining operations specialty	250

Top and Trim adhesive	250
Substrate Specific Applications:	
Metal to metal substrate specific adhesives	30
Plastic foam substrate specific adhesives	50
Porous material (except wood) substrate specific adhesives	50
Wood substrate specific adhesives	30
Fiberglass substrate specific adhesives	80
Sealants:	
Architectural sealant	250
Marine deck sealant	760
Nonmember roof sealant	300
Roadway sealant	250
Single-ply roof membrane sealant	450
Other sealant	420
Sealant Primers:	
Architectural non-porous sealant primer	250
Architectural porous sealant primer	775
Modified bituminous sealant primer	500
Marine deck sealant primer	760
Other sealant primer	750
Other:	
Other adhesives, adhesive bonding primers, adhesive primers or any other primers	250

a. Exception: The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 019113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. OPR and BoD documentation are included by reference for information only.

1.2 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. Related Documents:

1. OPR and BoD documentation are included by reference for information only.

1.3 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority.

D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings held as follows:

a. Weekly.
b. Biweekly.
c. Monthly.
d. Variable.

4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete construction checklists as Work is completed and provide to the Commissioning Authority as follows:

a. Format:

1) Paper.
2) Electronic.

b. Submit:

1) Daily.
2) Weekly.

7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings.

D. Provide Project-specific construction checklists and commissioning process test procedures.

E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

F. Prepare and maintain the Issues Log.

G. Prepare and maintain completed construction checklist log.

H. Witness systems, assemblies, equipment, and component startup.

I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 031000

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Form liners.
3. Shoring, bracing, and anchoring.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for formwork related to concrete pavement and walks.
2. Section 321316 "Decorative Concrete Paving" for formwork related to decorative concrete pavement and walks.

1.3 DEFINITIONS

A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.

b. Construction, movement, contraction, and isolation joints
c. Forms and form-removal limitations.
d. Shoring and reshoring procedures.
e. Anchor rod and anchorage device installation tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Waterstops.
5. Form-release agent.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for regional materials.>
3. <Double click to insert sustainable design text for liquid floor treatments and curing and sealing compounds.>

C. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301 (ACI 301M).

   a. Location of construction joints is subject to approval of the Architect.

3. Indicate location of waterstops.
4. Indicate form liner layout and form line termination details.
5. Indicate proposed schedule and sequence of stripping of forms, shoring removal, and reshoring installation and removal.
6. Indicate layout of insulating concrete forms, dimensions, course heights, form types, and details.

D. Samples:

1. For waterstops.
2. For Form Liners: 12-inch by 12-inch (305-mm by 305-mm) sample, indicating texture.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspection agency.

B. Research Reports: For insulating concrete forms indicating compliance with International Code Council Acceptance Criteria AC353.

C. Field quality-control reports.

D. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: An independent agency,[**acceptable to authorities having jurisdiction,**] qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

B. Mockups: Formed surfaces to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1. Build panel approximately [**100 sq. ft. (9.3 sq. m)**] **<Insert area>** in the location indicated or, if not indicated, as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Form Liners: Store form liners under cover to protect from sunlight.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."

2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

   a. For architectural concrete specified in Section 033300 "Architectural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

   1. Design cross ties to transfer the effects of the following loads to the cast-in-place concrete core:

      a. Wind Loads: As indicated on Drawings.

         1) Horizontal Deflection Limit: Not more than [**1/240**] [**1/360**] [**1/600**] [**1/720**] <**Insert ratio**> of the wall height.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

   1. Provide continuous, true, and smooth concrete surfaces.
   2. Furnish in largest practicable sizes to minimize number of joints.
   3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

      a. Plywood, metal, or other approved panel materials.
      b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

         1) APA HDO (high-density overlay).
         2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
         3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
         4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

   1. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces [**with gradual or abrupt irregularities**] [**without spiral or vertical seams**] not exceeding specified formwork surface class.

1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Form Liners:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Size: <**Insert dimensions**>.
3. Face Pattern: [**Smooth**] [**Ribbed**] [**Stone**] [**Brick**] [**Wood**] <**Insert pattern**>.

2.3 WATERSTOPS

A. Flexible Rubber Waterstops: U.S. Army Corps of Engineers CRD-C 513,[**with factory-installed metal eyelets,**] for embedding in concrete to prevent passage of fluids through joints, with factory fabricated corners, intersections, and directional changes.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Profile: [**Flat dumbbell with center bulb**] [**Flat dumbbell without center bulb**] [**Ribbed with center bulb**] [**Ribbed without center bulb**] [**As indicated**] <**Insert profile**>.
3. Dimensions: [**4 inches by 3/16 inch thick (100 mm by 4.8 mm thick)**] [**6 inches by 3/8 inch thick (150 mm by 10 mm thick)**] [**9 inches by 3/8 inch thick (225 mm by 10 mm thick)**] <**Insert dimensions**>; nontapered.

B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops[**with factory-installed metal eyelets**], for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals, with factory fabricate corners, intersections, and directional changes.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Profile: [**Flat dumbbell with center bulb**] [**Flat dumbbell without center bulb**] [**Ribbed with center bulb**] [**Ribbed without center bulb**] [**As indicated**] <**Insert profile**>.
3. Dimensions: [**4 inches by 3/16 inch thick (100 mm by 4.8 mm thick)**] [**6 inches by 3/16 inch thick (150 mm by 4.8 mm thick)**] [**6 inches by 3/8 inch thick (150 mm by 10 mm thick)**] [**9 inches by 3/16 inch thick (225 mm by 4.8 mm thick)**] [**9 inches by 3/8 inch thick (225 mm by 10 mm thick)**] <**Insert dimensions**>; nontapered.

C. Flexible PVC Waterstops: U.S. Army Corps of Engineers CRD-C 572,[**with factory-installed metal eyelets,**] for embedding in concrete to prevent passage of fluids through joints, with factory fabricate corners, intersections, and directional changes.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Profile: [**Flat dumbbell with center bulb**] [**Flat dumbbell without center bulb**] [**Ribbed with center bulb**] [**Ribbed without center bulb**] [**As indicated**] <**Insert profile**>.

3. Dimensions: [**4 inches by 3/16 inch thick (100 mm by 4.8 mm thick)**] [**6 inches by 3/8 inch thick (150 mm by 10 mm thick)**] [**9 inches by 3/8 inch thick (225 mm by 10 mm thick)**] <**Insert dimensions**>; nontapered.

D. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

E. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.4 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Form release agent for form liners shall be acceptable to form liner manufacturer.

F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301 (ACI 301M).

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M) and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes [**and**] [**Section 033300 "Architectural Concrete"**].

C. Limit concrete surface irregularities as follows:

1. Surface Finish-1.0: ACI 117 Class D, 1 inch (25 mm).
2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch (6 mm).
3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch (3.0 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.

1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips
2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
2. Locate temporary openings in forms at inconspicuous locations.

I. [**Chamfer**] [**Do not chamfer**] exterior corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches (305 mm).

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.
4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.

    a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls **as indicated on Drawings**.

    a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
5. Clean embedded items immediately prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.

1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 033000 "Cast-In-Place Concrete."
4. Secure waterstops in correct position at 12 inches (305 mm) on center.
5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.

    a. Miter corners, intersections, and directional changes in waterstops.
    b. Align center bulbs.

6. Clean waterstops immediately prior to placement of concrete.
7. Support and protect exposed waterstops during progress of the Work.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.

1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Protect exposed waterstops during progress of the Work.

3.4 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for [**24**] <**Insert number**> hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved[**at least 70 percent of**] its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.

1. Align and secure joints to avoid offsets.
2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a [**special inspector**] [**and**] [**qualified testing and inspecting agency**] to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000

SECTION 032000

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

B. Related Requirements:
1. Section 034500 "Precast Architectural Concrete" for reinforcing used in precast architectural concrete.
2. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.
3. Section 321316 "Decorative Concrete Paving" for reinforcing related to decorative concrete pavement and walks.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction contraction and isolation joints.
c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.
3. Structural thermal break insulated connection system.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for regional materials.>

3. <Double click here to insert sustainable design text for Type III Environmental Product Declaration.>
4. <Double click here to insert sustainable design text for sourcing of raw materials.>
5. <Double click here to insert sustainable design text for manufacturer inventory.>

C. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.

D. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For testing and inspection agency.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Mechanical splice couplers.

C. Field quality-control reports.

D. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

B. Mockups: Reinforcing for cast-concrete formed surfaces, to demonstrate tolerances and standard of workmanship.

1. Build panel approximately [**100 sq. ft. (9.3 sq. m) for formed surface**] <**Insert area**> in the location indicated on Drawings or, if not indicated, as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

C. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) in diameter.

1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch (25 mm), not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318 (ACI 318M).

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches (610 mm), whichever is greater.
2. Stagger splices in accordance with ACI 318 (ACI 318M).

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

   a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches (305 mm).

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.

4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a **special inspector and qualified testing and inspecting agency** to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel-reinforcement placement.

END OF SECTION 032000

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 033300 "Architectural Concrete" for general building applications of specially finished formed concrete.
4. Section 033543 "Polished Concrete Finishing" for concrete floors scheduled to receive a polished concrete finish.
5. Section 035300 "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.
6. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
7. Section 321313 "Concrete Paving" for concrete pavement and walks.
8. Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.
e. Special concrete finish Subcontractor.

2. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, and joint-filler strips.
c. Semirigid joint fillers.
d. Vapor-retarder installation.
e. Anchor rod and anchorage device installation tolerances.
f. Cold and hot weather concreting procedures.
g. Concrete finishes and finishing.
h. Curing procedures.
i. Forms and form-removal limitations.
j. Methods for achieving specified floor and slab flatness and levelness.
k. Floor and slab flatness and levelness measurements.
l. Concrete repair procedures.
m. Concrete protection.
n. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
o. Protection of field cured field test cylinders.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement
7. Aggregates.
8. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

9. Color pigments.
10. Fiber reinforcement.
11. Vapor retarders.
12. Floor and slab treatments.

13. Liquid floor treatments.
14. Curing materials.

    a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.

15. Joint fillers.
16. Repair materials.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for regional materials.>
3. <Double click to insert sustainable design text for liquid floor treatments and curing and sealing compounds.>

C. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Synthetic micro-fiber content.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

D. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

    a. Location of construction joints is subject to approval of the Architect.

E. Samples: For [**manufacturer's standard colors for color pigment**] [**vapor retarder**] **<Insert products>**.

F. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.

4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement.
7. Aggregates.
8. Admixtures.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Preconstruction Test Reports: For each mix design.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Field Quality-Control Testing Agency Qualifications: An independent agency, **acceptable to authorities having jurisdiction,** qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

E. Mockups: Cast concrete [**slab-on-ground**] [**and**] [**formed-surface**] panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Slab-On-Ground: Build panel approximately 15 feet by 15 feet (3.35 meters by 3.35 meters) <**Insert area**> in the location indicated or, if not indicated, as directed by Architect.

a. Divide panel into four equal panels to demonstrate saw joint cutting.

2. Formed Surfaces: Build panel approximately 100 sq. ft. (9.3 sq. m) <**Insert area**> in the location indicated or, if not indicated, as directed by Architect.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F (1.7 deg C), other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F (35 deg C).
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier

and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II, gray.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C595/C595M, Type IL, portland-limestone cement.
5. Silica Fume: ASTM C1240 amorphous silica.

C. Normal-Weight Aggregates: ASTM C33/C33M, [**Class 3S**] [**Class 3M**] [**Class 1N**] <**Insert class**> coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. (2.37 kg/cu. m) for moderately reactive aggregate or 3 lb./cu. yd. (1.78 kg/cu. m) for highly reactive aggregate, when tested in accordance with ASTM C1293 and

categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).

2. Maximum Coarse-Aggregate Size: As indicated.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Lightweight Aggregate: ASTM C330/C330M, [**1-inch (25-mm)**] [**3/4-inch (19-mm)**] [**1/2-inch (13-mm)**] [**3/8-inch (10-mm)**] nominal maximum aggregate size.

E. Air-Entraining Admixture: ASTM C260/C260M.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

G. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 FIBER REINFORCEMENT

A. Synthetic Monofilament Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, [**1/2 to 1-1/2 inches (13 to 38 mm)**] [**1 to 2-1/4 inches (25 to 57 mm)**] <**Insert dimensions**> long.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Synthetic Fibrillated Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, [**1/2 to 1-1/2 inches (13 to 38 mm)**] [**1 to 2-1/4 inches (25 to 57 mm)**] <**Insert dimensions**> long.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

C. Synthetic Macro-Fiber: Synthetic macro-fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, [**1 to 2-1/4 inches (25 to 57 mm)**] <**Insert dimensions**> long.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.4 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A[**, except with maximum water-vapor permeance of**] <**Insert rating**>; not less than 10 mils (0.25 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Sheet Vapor Retarder, Class C: ASTM E1745, Class C[**, except with maximum water-vapor permeance of**] <**Insert rating**>; not less than 10 mils (0.25 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

C. Sheet Vapor Retarder/Termite Barrier: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.03 perms; complying with ICC AC380. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Low-Temperature Flexibility: Pass at minus 15 deg F (minus 26 deg C); ASTM D146/D146M.
3. Puncture Resistance: 224 lbf (996 N) minimum; ASTM E154/E154M.
4. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D570.
5. Hydrostatic-Head Resistance: 231 feet (70 m) minimum; ASTM D5385.

D. Bituminous Vapor Retarder: ASTM E1993/E1993M, 110-mil- (2.8-mm-) thick, semiflexible, seven-ply sheet membrane, consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weather coating, and removable plastic release liner. Furnish manufacturer's accessories, including bonding asphalt, pointing mastics, and self-adhering joint tape.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Water-Vapor Permeance: 0.0011 grains/h x sq. ft. x inches Hg (0.063 ng/Pa x s x sq. m) when tested in accordance with ASTM E154/E154M.
3. Tensile Strength: 156 lbf/inch (27.35 kN/m) when tested in accordance with ASTM E154/E154M.
4. Puncture Resistance: 140 lbf (662N) when tested in accordance with ASTM E154/E154M.

2.5 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing [**3/8-inch (10-mm)**] [**No. 4 (4.75-mm)**] [**No. 8 (2.36-mm)**] <**Insert size or gradation**> sieve.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

C. Emery Dry-Shake Floor Hardener: [**Pigmented**] [**Unpigmented**], factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.

1. Color: [**As indicated by manufacturer's designation**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

D. Metallic Dry-Shake Floor Hardener: [**Pigmented**] [**Unpigmented**], factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.

1. Color: [**As indicated by manufacturer's designation**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

E. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

F. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Color: [**As indicated by manufacturer's designation**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

2.6 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. <Double click to insert sustainable design text for floor treatment products.>

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F (10 deg C): Black.
b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
c. Ambient Temperature Above 85 deg F (29 deg C): White.

D. Curing Paper: 8-feet- (2438-mm-) wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

E. Water: Potable or complying with ASTM C1602/C1602M.

F. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

G. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B[**, certified by curing compound manufacturer to not interfere with bonding of floor covering**].

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

H. Clear, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating[**, certified by curing compound manufacturer to not interfere with bonding of floor covering**].

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

I. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. <Double click to insert sustainable design text for floor treatment products.>

J. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. <Double click to insert sustainable design text for floor treatment products.>

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: [**ASTM D1751, asphalt-saturated cellulosic fiber**] [**or**] [**ASTM D1752, cork or self-expanding cork**].

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, [**epoxy resin with a Type A shore durometer hardness of 80**] [**aromatic polyurea with a Type A shore durometer hardness range of 90 to 95**] in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Floor Slab Protective Covering: 8-feet- (2438-mm-) wide cellulose fabric.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than [**4100 psi (29 MPa)**] <**Insert strength**> at 28 days when tested in accordance with ASTM C109/C109M.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Silica Fume: 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.11 CONCRETE MIXTURES

A. Class [**A**] <**Insert designation**>: Normal-weight concrete used for footings, grade beams, and tie beams.

1. Exposure Class: As indicated.
2. Minimum Compressive Strength: As indicated.
3. Maximum w/cm: As indicated.
4. Slump Limit: As indicated.
5. Air Content: As indicated.
6. Limit water-soluble, chloride-ion content in hardened concrete to: As indicated.

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M[**and ASTM C1116/C1116M**], and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches (150 mm), sealing vapor retarder to concrete.
4. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches (150 mm) on all sides, and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
4. Space vertical joints in walls **as indicated on Drawings**. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least **one-fourth** of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.

2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

    a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
    b. Remove projections larger than 1 inch (25 mm).
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
    e. Apply to concrete surfaces [**not exposed to public view**] <**Insert locations**>.

2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
b. Remove projections larger than 1/4 inch (6 mm).
c. Patch tie holes.
d. Surface Tolerance: ACI 117 (ACI 117M) Class B.

Revise locations in "Locations" Subparagraph below to suit Project, or delete subparagraph and indicate locations on Drawings. Retain second option if additional finishing is required.

e. Locations: Apply to concrete surfaces [**exposed to public view,**] [**to receive a rubbed finish,**] [**or to be covered with a coating or covering material applied directly to concrete**] **<Insert locations>**.

3. ACI 301 (ACI 301M) Surface Finish SF-3.0:

a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
b. Remove projections larger than 1/8 inch (3 mm).
c. Patch tie holes.
d. Surface Tolerance: ACI 117 (ACI 117M) Class A.

Revise locations in "Locations" Subparagraph below to suit Project, or delete subparagraph and indicate locations on Drawings. Retain second option if additional finishing is required.

e. Locations: Apply to concrete surfaces [**exposed to public view,**] [**to receive a rubbed finish,**] [**or to be covered with a coating or covering material applied directly to concrete**] **<Insert locations>**.

If retaining "Rubbed Finish" Paragraph below, retain "ACI 301 (ACI 301M) Surface Finish SF-2.0" or "ACI 301 (ACI 301M) Surface Finish SF-3.0" subparagraphs above.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

Retain one or more rubbed finishes in "Smooth-Rubbed Finish," "Grout-Cleaned Rubbed Finish," and "Cork-Floated Finish" subparagraphs below.

1. Smooth-Rubbed Finish:

a. Perform no later than one day after form removal.
b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
d. Maintain required patterns or variances as shown on Drawings or to match [**design reference sample**] [**field sample panels**] [**mockups**].

2. Grout-Cleaned Rubbed Finish:

a. Clean concrete surfaces after contiguous surfaces are completed and accessible.

b. Do not clean concrete surfaces as Work progresses.
c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
d. Wet concrete surfaces.
e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
f. Maintain required patterns or variances as shown on Drawings or to match [**design reference sample**] [**field sample panels**] [**mockups**].

3. Cork-Floated Finish:

a. Mix 1 part portland cement to 1 part fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint.
b. Mix 1 part portland cement and 1 part fine sand with sufficient water to produce a mixture of stiff grout. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
c. Wet concrete surfaces.
d. Compress grout into voids by grinding surface.
e. In a swirling motion, finish surface with a cork float.
f. Maintain required patterns or variances as shown on Drawings or to match [**design reference sample**] [**field sample panels**] [**mockups**].

Retain "Scrubbed Finish" Subparagraph below if scrubbed finish, which is usually applied to surfaces treated with a surface retarder, is required.

4. Scrubbed Finish: After concrete has achieved a compressive strength of from 1000 to 1500 psi (6.9 to 10.3 MPa), apply scrubbed finish.

a. Wet concrete surfaces thoroughly and scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed and aggregate is uniformly exposed.
b. Rinse scrubbed surfaces with clean water.
c. Maintain continuity of finish on each surface or area of Work.
d. Remove only enough concrete mortar from surfaces to match [**design reference sample**] [**field sample panels**] [**mockups**].

Before retaining "Abrasive-Blast Finish" Paragraph below, consider Contractor's ability to comply with OSHA's "Respirable Crystalline Silica Standard for Construction."

C. Abrasive-Blast Finish: Apply the following to as-cast surface finishes where indicated on Drawings:

1. Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi (13.8 MPa).
2. Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at the same age.
3. Surface Continuity:

    a. Perform abrasive-blast finishing as continuous operation, maintaining continuity of finish on each surface or area of Work.
    b. Maintain required patterns or variances in depths of blast to match [**design reference sample**] [**field sample panels**] [**mockups**].

4. Abrasive Blasting:

    a. Abrasive-blast corners and edges of patterns carefully, using backup boards to maintain uniform corner and edge lines.
    b. Determine type of nozzle pressure and blasting techniques required to match field sample.
    c. Depth of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surfaces to match field sample, as follows:

Texture in first four subparagraphs below is for example. Revise to suit Project.

        1) Brush Texture: Remove cement matrix to dull surface sheen and expose face of fine aggregate, with no significant reveal.
        2) Light Texture: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color, with maximum reveal of 1/16 inch (1.5 mm).
        3) Medium Texture: Generally, expose coarse aggregate with slight reveal and with a maximum reveal of 1/4 inch (6 mm).
        4) Heavy Texture: Expose and reveal coarse aggregate to a maximum projection of one-third its diameter, with reveal range of 1/4 to 1/2 inch (6 to 13 mm).

    d. Maintain required patterns or variances in reveal projection to match [**design reference sample**] [**field sample panels**] [**mockups**].

D. High-Pressure Water-Jet Finish: Apply the following to as-cast surface finishes where indicated on Drawings:

1. Perform high-pressure water jetting on concrete that has achieved a minimum compressive strength of 4500 psi (31 MPa).
2. Coordinate with formwork removal to ensure that surfaces to be high-pressure water-jet finished are treated at same age for uniform results.
3. Surface Continuity: Perform high-pressure water-jet finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work.
4. Maintain required patterns or variances in reveal projection to match [**design reference sample**] [**field sample panels**] [**mockups**].

Retain "Bushhammer Finish" Paragraph below if required. ACI 301 (ACI 301M) requires that concrete have a minimum compressive strength of 4500 psi (31 MPa). Before retaining, consider Contractor's ability to comply with OSHA's "Respirable Crystalline Silica Standard for Construction."

E. Bushhammer Finish: Apply the following to as-cast surface finishes where indicated on Drawings:

1. Perform bushhammer finish to concrete that has achieved a minimum compressive strength of 4500 psi (31 MPa).
2. Surface Continuity:

   a. Perform bushhammer finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work.

3. Surface Cut:

   a. Maintain required depth of cut and general aggregate exposure.
   b. Use power tool with hammer attachments for large, flat surfaces, and use hand hammers for small areas, at corners and edges, and for restricted locations where power tools cannot reach.

4. Remove impressions of formwork and form facings with exception of tie holes.
5. Maintain required patterns or variances of cut as shown on Drawings or to match [**design reference sample**] [**field sample panels**] [**mockups**].
6. Maintain control of concrete chips, dust, and debris in each Work area, limiting migration of airborne materials and dust by use of tarpaulins, wind-breaks, or similar devices.

F. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

Retain one or more of "Scratch Finish," "Float Finish," "Trowel Finish," "Trowel and Fine-Broom Finish," "Broom Finish," and "Slip-Resistive Finish" paragraphs below for types of slab finishes required. Coordinate slab finishes retained with finish schedule, or indicate location of each finish on Drawings.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch (6 mm) in one direction.

Revise locations of scratch finish in subparagraph below to suit Project, or delete subparagraph and indicate locations on Drawings.

3. Apply scratch finish to surfaces [**to receive concrete floor toppings**] [**to receive mortar setting beds for bonded cementitious floor finishes**] **<Insert locations>**.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.

Revise locations of float finish in subparagraph below to suit Project, or delete subparagraph and indicate locations on Drawings.

3. Apply float finish to surfaces [**to receive trowel finish**] [**and**] [**to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo**] **<Insert locations>**.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.

Revise locations of trowel finish in first subparagraph below to suit Project, or delete subparagraph and indicate locations on Drawings.

6. Apply a trowel finish to surfaces [**exposed to view**] [**or**] [**to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system**] **<Insert locations>**.

7. Finish surfaces to the following tolerances, in accordance with ASTM E1155 (ASTM E1155M), for a randomly trafficked floor surface:

a. Slabs on Ground:

ACI 301 (ACI 301M) suggests that all residential floors and nonresidential floors less than 10,000 sq. ft. (929 sq. m) be measured by straightedge method and that other nonresidential floors be measured by F-number system. Retain first subparagraph below for floor areas less than 10,000 sq. ft. (929 sq. m). Fourth option is requirement for gauged porcelain tile.

1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed [**1/4 inch (6 mm)**] [**3/16 inch (4.8 mm)**] [**1/8 inch (3 mm)**] [**1/8 inch (3 mm) and also no more than 1/16 inch (1.6 mm) in2 feet (610 mm)**].

Retain first subparagraph below for floor areas 10,000 sq. ft. (929 sq. m) and larger. Retain floor flatness (F_F) and floor levelness (F_L) values required for Project from first four subparagraphs below, or revise values to suit type of floor. ACI 302.1R suggests values in first subparagraph be used for carpeted slabs; those in second for thin floor coverings; and those in third for very flat floors for high-speed forklifts, air pallets, and ice and roller rinks. Those in fourth subparagraph are common for polished concrete floors.

2) Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.
3) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.
4) Specified overall values of flatness, F_F 45; and of levelness, F_L 35; with minimum local values of flatness, F_F 30; and of levelness, F_L 24.
5) Specified overall values of flatness, F_F 50; and of levelness, F_L 25; with minimum local values of flatness, F_F 40; and of levelness, F_L 17.

b. Suspended Slabs:

ACI 301 (ACI 301M) suggests that all residential floors and nonresidential floors less than 10,000 sq. ft. (929 sq. m) be measured by straightedge method and that other nonresidential floors be measured by F-number system. Retain first subparagraph below for floor areas less than 10,000 sq. ft. (929 sq. m). Fourth option is requirement for gauged porcelain tile.

1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed [**1/4 inch (6 mm)**] [**3/16 inch (4.8 mm)**] [**1/8 inch (3 mm)**] [**1/8 inch (3 mm) and also no more than 1/16 inch (1.6 mm) in 2 feet (610 mm)**].

Retain first subparagraph below for floor areas 10,000 sq. ft. (929 sq. m) and larger. Retain floor flatness (F_F) and floor levelness (F_L) values required for Project from first three subparagraphs

below, or revise values to suit type of floor. ACI 302.1R suggests values in first subparagraph be used for carpeted slabs; those in second for thin floor coverings; and those in third for very flat floors for high-speed forklifts, air pallets, and ice and roller rinks.

2) Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.
3) Specified overall values of flatness, F_F 35; and of levelness, F_L 20; with minimum local values of flatness, F_F 24; and of levelness, F_L 15.
4) Specified overall values of flatness, F_F 45; and of levelness, F_L 35; with minimum local values of flatness, F_F 30; and of levelness, F_L 24.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces [**indicated on Drawings**] [**where ceramic or quarry tile is to be installed by either thickset or thinset method**]. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

Retain "Broom Finish" Paragraph below if applicable. Broom finish is generally used on exterior concrete steps and platforms, ramps, and other surfaces subject to light foot traffic.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

Retain "Slip-Resistive Finish" Paragraph below if applicable. This finish is generally used on interior and exterior concrete treads, platforms, and ramps subject to moderate foot traffic.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive [**aggregate**] [**aluminum granule**] finish to concrete stair treads, platforms, ramps as indicated on Drawings

1. Apply in accordance with manufacturer's written instructions and as follows:

a. Uniformly spread [**25 lb/100 sq. ft. (12 kg/10 sq. m)**] <**Insert rate**> of dampened slip-resistive [**aggregate**] [**aluminum granules**] over surface in one or two applications.
b. Tamp aggregate flush with surface, but do not force below surface.

Revise float finish in first subparagraph below to trowel finish if required.

c. After broadcasting and tamping, apply float finish.
d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive [**aggregate**] [**aluminum granules**].

Retain Dry-Shake Floor Hardener Finish Paragraph below if pigmented or unpigmented dry-shake floor hardener finish is required.

H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces in accordance with manufacturer's written instructions and as follows:

Consult manufacturers and revise rate of application in first subparagraph below if required. This rate is usually recommended for light traffic.

1. Uniformly apply dry-shake floor hardener at a rate of [**100 lb/100 sq. ft. (49 kg/10 sq. m)**] <**Insert rate**> unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating.
3. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.

Coordinate selection of curing compounds for compatibility with dry-shake floor hardener, and revise lists of manufacturers in Part 2 accordingly if required.

4. After final floating, apply a trowel finish.
5. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories, as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

            a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).

b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

   a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

   a) Water.
   b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches (150 mm) and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by

curing compound manufacturer[**unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project**].

g. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 TOLERANCES

A. Conform to ACI 117 (ACI 117M).

3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than [**three**] [**seven**] [**14**] [**28**] days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least [**one**] [**six**] month(s).
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete.

   a. Limit cut depth to 3/4 inch (19 mm).
   b. Make edges of cuts perpendicular to concrete surface.
   c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
   d. Fill and compact with patching mortar before bonding agent has dried.
   e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

   a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
   b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

a. Correct low and high areas.
b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

   a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

   a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

   a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations.
   b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete.

   a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around.
   b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
   c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
   d. Place, compact, and finish to blend with adjacent finished concrete.
   e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar.

   a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
   b. Dampen cleaned concrete surfaces and apply bonding agent.

c. Place patching mortar before bonding agent has dried.
d. Compact patching mortar and finish to match adjacent concrete.
e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: **[Owner will engage] [Engage]** a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.
2) Name of testing agency.
3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.
8) Date and time sample was obtained.
9) Truck and batch ticket numbers.
10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results.
13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.

14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

   a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; **ASTM C173/C173M volumetric method, for structural lightweight concrete**.

   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

   a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

6. Compression Test Specimens: ASTM C31/C31M:

    a. Cast and laboratory cure two sets of [**two**] [**three**] [**four**] 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
    b. Cast, initial cure, and field cure [**two**] <**Insert number**> sets of [**two**] [**three**] [**four**] standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39/C39M.

    a. Test one set of [**two**] [**three**] [**four**] laboratory-cured specimens at seven days and one set of two specimens at 28 days.
    b. Test one set of [**two**] [**three**] [**four**] field-cured specimens at seven days and one set of two specimens at 28 days.
    c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

        1) Acceptance criteria for concrete strength to be in accordance with ACI 301 (ACI 301M), Section 1.6.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 (ASTM E1155M) within [**24**] [**48**] [**72**] <**Insert number**> hours of completion of floor finishing and promptly report test results to Architect.

3.16 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 033543
POLISHED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes polished concrete finishing of cast-in-place concrete floor or topping slab including supplementary products necessary to complete the concrete installation.

1. Process includes the application of sealer/hardener and polishing of concrete to specified level of finish.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

1.3 INFORMATIONAL SUBMITTALS

A. Maintenance Data: For inclusion in maintenance manual.

1. Include instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.

a. Show typical components and requirements of installation.
b. Size: Not less than 6 ft. x 6 ft. (1.8 m x 1.8 m).

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.

a. Do not proceed with remaining work until workmanship, level of polished sheen, aggregate exposure, and dye color, is approved by Architect.

4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.

1) Cast-in-place concrete requirements:

a) Coordination of curing methods/procedures.
b) Protection of concrete substrate during construction and prior to polishing process
c) Phasing and scheduling for each step of grinding, honing and polishing operations.
d) Application of color.
e) Application of liquid applied products.
f) Protecting polished concrete floors after polishing work is complete.

f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.6 PROJECT CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.

1. Prohibit use of markers, spray paint, and soapstone.
2. Prohibit improper application of liquid membrane film forming curing compounds.
3. Prohibit vehicle parking over concrete surfaces.
4. Prohibit pipe-cutting operations over concrete surfaces.

5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
6. Prohibit ferrous metals storage over concrete surfaces.
7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
8. Protect from acids and acidic detergents contacting concrete surfaces.
9. Protect from painting activities over concrete surfaces.

    a. Do not allow protective tapes to come into contact with concrete.

B. Environmental Limitations: Comply with manufacturers written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting performance.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, densifies and is suitable for polished concrete surfaces.

1. Manufacturers and Products:

    a. Advanced Floor Products Retro-Plate System: Retro-Plate 99.
    b. ARDEX Engineered Cements; PC Finish.
    c. L&M Construction Chemicals, Inc.: FGS Hardener Plus.
    d. QuestMark, a division of CentiMark Corporation: DiamondQuest Densifying Impregnator Application.

2. Basis of Design: Advanced Floor Products Retro-Plate System; Retro-Plate 99 Sealer/Hardener/Densifier Agent.

B. Dye: Non-film forming soluble colorant dissolved in a carrier designed to penetrate and alter coloration and appearance of a concrete floor surface without a chemical reaction.

1. Basis of Design (Product Standard): Ameripolish; Polished Concrete Solvent Dye System.

a. Color: As scheduled or as indicated in Design Selections.

C. Stainguard Impregnating Stain Protection: Non film forming stain and food resistant penetrating sealer designed to be applied to densified and polished concrete which meets the requirements of OSHA for slip resistance as tested by ASTM D 2047 and stain resistance of ASTM D 1308.

1. Basis of Design (Product Standard): Advanced Floor Products Retro-Plate System; Retro-Guard.

2.4 ACCESSORIES

A. Repair Material: Product designed and recommended for crack repair and surface imperfections. Material shall remain bonded and adhered after polishing concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate.

B. Grout Material: A thin mortar used for filling voids:

1. Epoxy, urethane, polyurea, or polyaspartic resins.
2. Latex or acrylic binders mixed with cement dust from previous grinding steps.
3. Silicate binders mixed with cement dust from previous grinding steps.

C. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

1. Basis of Design: McTech Group; EZcover Protective Covering.

D. Joint Filler: Polyurea sealant, VOC compliant, non-staining compatible with polished concrete, Shore A-85.

1. Basis of Design (Product Standard): Advanced Floor Product; CreteFill Pro 85 MI Moisture Insensitive.

2.5 POLISHING EQUIPMENT

A. Field Grinding and Polishing Equipment: Multiple head, counter rotating, various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete.

1. Dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.
2. Wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.

B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines producing results matching field grinding and polishing equipment.

C. Burnishing Equipment: High speed walk-behind or ride-on burnisher equipped with burnishing pads, capable of generating 2600 revolutions per minute with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 deg F (minus 7 deg C).

D. Diamond Tooling: Abrasive tools containing industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc.) attached to rotating heads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive concrete finishing, products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

a. Use manufacturers recommended cleaning products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that concrete substrates are dry and free of curing compounds and other materials that may interfere with finish installation.
2. Determine dryness characteristics by performing the following tests as recommended by flooring manufacturer.

3.4 FLOOR AND SLAB TREATMENTS

A. Dye or Pigmented Micro Stain Application:

1. Apply solution by methods and techniques required by manufacturer to produce finish matching approved field mock-ups.
2. Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.
3. Maintain consistent saturation throughout application.
4. Avoid splashing, dripping, or puddling of solution on adjacent substrates.
5. When color matches approved mock-ups, neutralize as required by manufacturer.

B. Polished Concrete Floors: Perform all polishing procedures to ensure a consistent appearance from wall to wall.

C. Initial Grinding:

1. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
2. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.

3. Achieve maximum refinement with each pass before proceeding to finer grit tools.
4. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
5. Continue grinding until aggregate exposure matches approved field mock-ups.

D. Treating Surface Imperfections:

1. Mix patching compound or grout material with dust created by grinding operations, manufacturer’s tint, or sand to match color of adjacent concrete surfaces.
2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

E. Liquid Sealer/Hardener/Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow curing according to manufacturer’s instructions.

F. Grout Grinding:

1. Use grinding equipment and appropriate grit and bond diamond tooling.
2. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

G. Honing:

1. Hone concrete in one direction and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.
2. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

H. Polishing for Level 1 - Low Gloss Appearance:

1. Begin polishing in one direction starting with grit range of 100 or less.
2. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of gloss has been achieved.
3. Achieve maximum refinement with each pass before proceeding to finer grit pads.
4. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
5. Stainguard Protection: Mix, thin and uniformly apply two coats in crosshatch pattern according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure. Burnish and heat to 90 F degrees, each coat.
6. Final Polish: Using burnishing equipment and finest grit diamond impregnated abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

I. Polishing for Level 2 - Medium Gloss Appearance:

1. Begin polishing in one direction starting with grit range of 100 to 400.
2. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of gloss has been achieved.

3. Achieve maximum refinement with each pass before proceeding to finer grit pads.
4. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
5. Stainguard Protection: Mix, thin and uniformly apply two coats in crosshatch pattern according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure. Burnish and heat to 90 F degrees, each coat.
6. Final Polish: Using burnishing equipment and finest grit diamond impregnated abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

J. Polishing for Level 3 - High Gloss Appearance or Level 4 - Very High Gloss Appearance:

1. Begin polishing in one direction starting with grit range of 800 and higher.
2. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of gloss has been achieved.
3. Achieve maximum refinement with each pass before proceeding to finer grit pads.
4. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
5. Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure.
6. Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

K. Final Polished Concrete Floor Finish with Aggregate Exposure:

1. Aggregate Exposure Class A - Cream Finish: Polish Portland cement paste resulting in little or no aggregate exposure.
2. Aggregate Exposure Class B - Fine / Sand Aggregate Finish: Remove not more than 1/16 in (1.5 mm) of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.
3. Aggregate Exposure Class C - Medium Aggregate Finish: Remove not more than 1/8 in (3 mm) of concrete surface by grinding and polishing resulting in majority of exposure displaying medium aggregate with no, or small amount of, large aggregate at random locations.
4. Aggregate Exposure Class D - Large Aggregate Finish: Remove not more than 1/4 in (6 mm) of concrete surface by grinding and polishing resulting in majority of exposure displaying large aggregate with no, or small amount of, fine aggregate at random locations
5. Finished Gloss Level 1 - Low Gloss Appearance:
   a. Procedure: Recommended not less than 4 step process with full refinement of each diamond tool with one application of densifier.
   b. Gloss Measurement: Determine the specular gloss by incorporating the following:
      1) Reflective Clarity Reading: Not less than 20 according to ASTM D5767 prior to the application of sealers.
      2) Reflective Sheen Reading: Not less than 15 according to ASTM D523 prior to the application of sealers.
6. Finished Gloss Level 2 - Medium Gloss Appearance:
   a. Procedure: Recommended not less than 4 step process with full refinement of each diamond tool with one application of densifier.
   b. Gloss Measurement: Determine the specular gloss by incorporating the following:

1) Reflective Clarity Reading: Not less than 55 according to ASTM D5767 prior to the application of sealers.
2) Reflective Sheen Reading: Not less than 25 according to ASTM D523 prior to the application of sealers.

7. Finished Gloss Level 3 - High Gloss Appearance:

a. Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
b. Gloss Measurement: Determine the specular gloss by incorporating the following:

1) Reflective Clarity Reading: Not less than 65 according to ASTM D5767 prior to the application of sealers.
2) Reflective Sheen Reading: Not less than 35 according to ASTM D523 prior to the application of sealers.

8. Finished Gloss Level 4 - Very High Gloss Appearance:

a. Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
b. Gloss Measurement: Determine the specular gloss by incorporating the following:

1) Reflective Clarity Reading: Not less than 85 according to ASTM D5767 prior to the application of sealers.
2) Reflective Sheen Reading: Not less than 50 according to ASTM D523 prior to the application of sealers.

3.5 PROTECTION

A. Covering: After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

3.6 FINISH SCHEDULE

A. Polished Concrete Flooring - PCF01: Natural Gray

1. Description: Retro Plate 99 Polishing System with Two-Coats Stainguard.
2. Sheen: Level 2, 800 Grit, Medium Gloss Sheen
3. Sheen: Level 3, 1500 Grit, High Gloss Sheen
4. Aggregate Exposure: Class A Polished Cream
5. Aggregate Exposure: Class B Salt and Pepper
6. Pattern: Decorative saw cut pattern as indicated on drawings.

B. Polished Concrete Flooring - PCF02: Stained

1. Description: Retro Plate 99 Polishing System and Ameripolish Dye with Two-Coats Stainguard.
2. Dye Color: As selected by Architect from manufacturer's full range.
3. Dye Color: Insert color
4. Sheen: Level 2, 800 Grit, Medium Gloss Sheen
5. Sheen: Level 3, 1500 Grit, High Gloss Sheen
6. Aggregate Exposure: Class A Polished Cream
7. Aggregate Exposure: Class B Salt and Pepper
8. Pattern: Decorative saw cut pattern as indicated on drawings.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 042100
MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exterior, non-load bearing masonry veneer units and supplementary items necessary for installation.

1.2 DEFINITIONS

A. Masonry Veneer Terminology: Refer to BIA 2 and other referenced quality standards.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each type of product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

a. Kind, size, and color of masonry unit.
b. Manufactured accessory product.
c. Cleaning products, including application procedures.

B. Shop Drawings: Show details of construction and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Including, but not limited to, the following:

1. Flashing: Large-scale details for each element of flashing system showing layout, profiles, methods of joining, and anchorage details; including lintel units, shelf units, corner units, end dam units, conditions showing interface and relationship to adjacent materials, and other special applications.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification Purposes: Submit samples for each item listed below of size and construction indicated. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Masonry Veneer: Full-size samples for each different unit indicated.
2. Pigmented and Color Aggregate Mortar: Make samples using same sand and mortar ingredients to be used on Project; label samples to indicate type and amount of pigments used.
3. Accessories: Samples of manufactured products, including anchors, ties, cavity drainage material, flashing materials, weeps, vents, and other accessories.
4. Flashing: Samples of each shape, profile, intersection and transition required, not less than 12 in (300 mm) long, including end dam, and splice/lap joint for lintel and shelf angle flashing; demonstrate soldering quality.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C67.

2. Integral water repellant used in decorative CMU.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures, if any.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention.

D. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

1.5 QUALITY ASSURANCE

A. Quality Standards: In addition to specified requirements, comply with TMS 402/602 and local building code, whichever is more stringent.

B. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

C. Installer Qualifications:

1. Experience: Installer personnel with not less than 10 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 10 years of experience installing products and systems similar to scope of this Project.

D. Hot and Cold Weather Work Plan: Written plan detailing methods, materials and equipment to be used to comply with weather requirements.

E. Masonry Veneer Cleaning Plan: Based on technical information provided by respective manufacturer for each masonry veneer unit to be cleaned, prepare written plan for cleaning exposed masonry veneer surfaces, prepared by commercial cleaning compound manufacturer, with signature of installer indicating acceptance and include following information:

1. Qualifications of applicators.
2. Products to be used and application procedures.
3. Masonry veneer surfaces to be cleaned and required preparations.
4. Environmental requirements by authorities having jurisdiction for use and discharge of cleaning effluents.
5. Protection of surrounding areas, landscaping, and building surfaces adjacent to area of cleaning.

F. Sample Panels: Prior to installing masonry, build as many sample panels as required to verify selections made under submittals and to demonstrate aesthetic effects using specified materials:

1. Build approximately 48 in (1200 mm) square for each type of exposed masonry units.
2. Locate at locations indicated or, if not indicated, as directed by Architect.

3. Clean exposed faces with masonry cleaner specified.
4. Where masonry is to match existing masonry, erect panels adjacent and parallel to an existing, south-facing wall.
5. Notify Architect 7 days in advance of the dates and times when panels will be constructed.
6. Protect accepted approved sample panels with weather-resistant membrane.
7. Maintain during construction in an undisturbed condition as a standard for judging completed Work.
8. Acceptance Approval of panels is for following aesthetic qualities; acceptance approval does not constitute acceptance approval of deviations from Contract Documents, unless specifically accepted approved by Architect in writing:

    a. Color, texture, and blending of masonry units.
    b. Color and blending of mortar.
    c. Relationship of mortar and sealant colors to masonry unit colors.
    d. Tooling of joints.
    e. Effectiveness of masonry cleaner.
    f. Other aesthetic qualities as determined by the Architect.

9. When directed, demolish and remove mock-up from Project site, including foundations.

G. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

    a. Show typical components, attachments to building structure, and requirements of installation.
    b. Include control joints and through wall flashing with drip edge.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

    a. Architect.
    b. Contractor, including superintendent.
    c. Installer, including project manager and supervisor.
    d. If requested, Manufacturer's qualified technical representative.
    e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Label pallets of masonry veneer units with manufacturers name, product name, and information required to identify products.

B. Storage:

1. Masonry Veneer Units: Store on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
2. Cementitious Materials: Store on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
3. Aggregates: Store where grading and other required characteristics can be maintained and contamination avoided.
4. Accessories: Store to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection during Work: Prevent excess moisture from entering Work in progress.

1. Cover tops of walls, projections, and sills with water-repellent tarps or heavy plastic sheets at end of each day's Work.
2. Cover partially completed masonry veneer when construction is not in progress.
3. Extend cover minimum of 24 in (600 mm) down both sides and hold cover securely in place.
4. Protect door and window frames from damage.

B. Stain Prevention: Prevent mortar and soil from staining exposed masonry veneer. Immediately remove mortar and soil from exposed masonry veneer.

1. Protect base of walls from rain-splashed mud and mortar splatter.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, and other adjacent with painted and integral finishes from mortar droppings.
4. Turn scaffolding planks near Work on edge at end of each day to prevent rain from splashing mortar droppings or dirt onto face of exposed masonry veneer.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.

1. Do not apply when ambient temperature is less than 32 deg F (0 deg C) or when 40 deg F (4.4 deg C) or less and falling.
2. Provide heat and protection (temporary or permanent) as required to protect Work from freezing for not less than 48 hours after application.

3. Distribute heat uniformly to prevent concentration of heat near sources; provide deflection or protective screens.
4. Use liquid cleaning methods only when air temperature is 40 deg F (4.4 deg C) and above and will remain so until masonry veneer has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

1. Protect Work against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial.
2. Apply and cure work as required by climatic and job conditions to prevent dryout during cure period.
3. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Masonry Units: Obtain exposed masonry veneer units of a uniform texture and color, or a uniform blend within ranges accepted for these characteristics.

C. Cementitious Materials: Obtain cementitious ingredients of a uniform quality, including color, for each component.

2.3 MASONRY UNITS, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in standard. Do not install units where defects, including dimensions that vary from specified dimensions by

more than stated tolerances, will be exposed in completed Work or will impair quality of completed masonry veneer.

C. Special Shapes: Provide shapes indicated and as follows for each form of masonry unit required:

1. For applications requiring units of form, color, texture, and size on exposed surfaces that cannot be produced by sawing standard unit sizes.
2. For applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
3. For applications where stretcher units cannot accommodate special conditions including those at corners, movement joints, bond beams, sashes, and lintels.
4. For units without cores or frogs and with exposed surfaces finished for ends of sills, caps, and similar applications that would otherwise expose unfinished unit surfaces.

D. Match Existing Masonry Veneer: Wherever "match existing" indicated, provide masonry veneer unit of matching color, texture, and size as existing adjacent masonry veneer work.

2.4 FACE BRICK MASONRY UNITS

A. Product Quality Standard: ASTM C 216 or ASTM C 652, Grade SW, Type FBS.

1. Unit Compressive Strength: Minimum 3000 psi (20.7 MPa) for average of 5 bricks, and 2500 psi (17.2 MPa) for individual brick, gross area, according to ASTM C 67, Section 7.
2. Hot and Cold Water Testing:

a. Water Absorption: Maximum 17.0 percent for average of 5 bricks, and 20.0 percent for individual brick, according to ASTM C 67, Section 8 for 5 hour boiling test.
b. Saturation Coefficient: Maximum 0.78 for average of 5 brick, and 0.80 for individual brick.
c. Requirement Waivers:

1) Absorption: Saturation coefficient requirement may be waived if there is maximum 8.0 percent absorption of random sampling of 5 bricks according to ASTM C 67, Section 8 for 24 hour submersion test.
2) Freezing and Thawing: Water absorption and saturation coefficient requirements may both be waived if there is maximum 0.5 percent loss in dry weight of any individual brick according to ASTM C 67, Section 9, for 50 cycles of freezing and thawing.

3. Initial Rate of Absorption: Between 5 and 25 g/m per 30 sq in (0.02 sq m) according to ASTM C 67, Section 10. Use of coating to establish initial rate of absorption is not permitted and will not be allowed.
4. Efflorescence: Rated "not effloresced" according to ASTM C 67, Section 11.
5. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing according to ASTM C 67, Section 8, with no observable difference in applied finish when viewed from 10 ft (3 m) under an minimum illumination of 50 foot-candles (538 lumen/square meter).

B. Basis of Design: As scheduled or as indicated in Design Selections.

2.5 CALCIUM SILICATE MASONRY UNITS

A. Product Quality Standard: ASTM C 73, Grade SW.

1. Compressive Strength: Minimum 6600 psi (45.5 MPa) according to ASTM C 170.
2. Absorption: Maximum 8.8 percent according to ASTM C 97.
3. Density: Minimum 129 pcf (2066 kg/cu m) according to ASTM C 97.

4. Modulus of Rupture: Minimum 770 psi (5.3 MPa) according to ASTM C 99.
5. Freeze-Thaw Durability: No observable distress.

B. Basis of Design: As scheduled or as indicated in Design Selections.

2.6 DECORATIVE CONCRETE MASONRY UNITS

A. Product Quality Standard: ASTM C 90.

1. Unit Compressive Strength: Minimum average net area compressive strength of 1900 psi (13.1 MPa) for 3 units, and minimum 1700 psi (11.7 MPa) for individual unit.
2. Weight Classification: Medium weight.

B. Integral Water Repellent: Provide units made with integral water repellent.

1. Description: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on back of test specimen.
2. Manufacturers and Products:

a. Addiment Inc.; Block Plus W-10.
b. Grace Construction Products; Dry-Block.

C. Basis of Design: As scheduled or as indicated in Design Selections.

2.7 PRE-FACED CONCRETE MASONRY UNITS

A. Product Quality Standard: ASTM C 90, with manufacturer's standard smooth resinous facing complying with ASTM C 744.

1. Unit Compressive Strength: Units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) for 3 units, and minimum 1700 psi (11.7 MPa) for individual unit.
2. Weight Classification: Lightweight.

B. Basis of Design: As scheduled or as indicated in Design Selections.

2.8 NATURAL STONE MASONRY UNITS

A. Basis of Design: As scheduled or as indicated in Design Selections.

2.9 CAST STONE MASONRY UNITS

A. Provide cast stone masonry units complying with ASTM C 1364.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.

B. Reinforce units as indicated and as required by ASTM C 1364. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of material.

C. Fabricate units with sharp arris and details accurately reproduced with indicated texture on all exposed surfaces, unless otherwise indicated.

1. Slope exposed horizontal surfaces at least 1:12, unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements, unless otherwise indicated.

D. Cure and finish units as follows:

1. Cure units in totally enclosed curing room under dense fog and water spray at 95 percent relative humidity for 24 hours.
2. Yard-cure units until the sum of the mean daily temperatures for each day equal or exceed 350 deg F (177 deg C).
3. Acid etch units to remove cement film from surfaces indicated to be finished.

E. Basis of Design: As scheduled or as indicated in Design Selections.

2.10 SHELF ANGLES AND LINTELS

A. Steel Angle Lintels: Materials complying with Division 05 Section Metal Fabrications for loose masonry lintels (Designation MF), with schedule as shown on the Drawings.

B. Cast-in-Place Concrete Lintels: Concrete materials complying with Division 03 Section Cast-in-Place Concrete for color, texture, and compressive strength indicated or required, and with reinforcing bars to support loads indicated.

C. Precast Concrete Lintels: As specified in Division 03 Section Architectural Precast Concrete.

D. Masonry Lintels: Prefabricated or built-in-place masonry lintels as shown of the Drawings made from masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure prefabricated lintels before handling and installing.

2.11 MORTAR MATERIALS

A. Portland Cement:

1. Material Quality Standard: ASTM C 150, Type I; except Type III may be used for cold-weather construction.
2. Color: Natural gray color or white cement as required to produce mortar color required.
3. Manufacturers:

   a. LafargeHolcim.
   b. Lehigh Cement Co.
   c. Lone Star Industries, Inc.
   d. Rinker Materials.
   e. Royal White Cement.

4. Types of Cements Not permitted:

   a. Masonry Cement: ASTM C 91.
   b. Mortar Cement: ASTM C 1329.

B. Hydrated Lime:

1. Material Quality Standard: ASTM C 207, Type S.
2. Manufacturers:

   a. Graymont Dolime (OH) Inc.
   b. Rockwell Lime Co.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

1. Product Quality Standard: ASTM C 144.
2. Mortar Exposed to View: Use washed aggregate consisting of natural sand or crushed stone.
3. Joints Less Than 1/4 in (6 mm) Thick: Use aggregate graded with 100 percent passing No. 16 sieve.

D. Aggregate for White Mortar: Natural white sand or ground white stone, as required to match approved sample.

E. Aggregate for Colored Mortar: Natural sand or ground marble, granite, or other sound stone, as required to match approved sample.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Quantity Limitations: Pigments shall not exceed 10 percent of Portland cement by weight for mineral oxides or 2 percent for carbon black.
2. Manufacturers and Products:

a. Bayer Corp., Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
b. Davis Colors; True Tone Mortar Colors.
c. Solomon Grind-Chem Service, Inc.; SGS Mortar Colors.

G. Colored Portland Cement-Lime Mix: Packaged blend made from Portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Quantity Limitations: Pigments shall not exceed 10 percent of Portland cement by weight or 2 percent for carbon black.
2. Manufacturers and Products:

a. Capital Materials Corp.; Riverton Portland Cement Lime Custom Color.
b. Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
c. LafargeHolcim; Eaglebond.
d. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

H. Water-Repellent Mortar Admixture for Decorative Concrete Masonry Units:

1. Description: Liquid water-repellent mortar admixture intended for use with concrete masonry veneer units, containing integral water repellent by same manufacturer.
2. Manufacturers and Products:

a. Addiment Inc.; Mortar Tite.
b. Grace Construction Products; Dry-Block Mortar Admixture.
c. Master Builders, Inc.; Color Cure Mortar Admix or Rheomix Rheopel.

I. Water: Potable, clean and free of amounts of oils, acids, alkalies, salts, organic materials, or other substances that are deleterious to mortar or any metal within the wall.

2.12 REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

B. Masonry Joint Reinforcement for Multi-wythe Masonry: As specified in Division 04 Section Concrete Unit Masonry.

2.13 VENEER ANCHORS AND TIES

A. General: For attaching masonry veneer to a back-up structure, use two-piece assemblies that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall; suitable for attachment conditions indicated.

1. Corrugated ties are not permitted.

B. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 in (1.3 mm).

C. Materials for Adjustable Masonry Veneer Anchors: Use one of the following. Mill-galvanized ties are not permitted.

1. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82 / A 82M with ASTM A 153 / A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008 / A 1008M, commercial sheet, hot-dip galvanized after fabrication to comply with ASTM A 153 / A 153M, Class B coating.
3. Stainless Steel Wire: ASTM A 580 / A 580M, AISI Type 304.
4. Stainless Steel Sheet: ASTM A 167, A 240, or A 666, AISI Type 304.
5. Stainless-Steel Bars and Shapes for Stone Trim: ASTM A 276 or ASTM A 666, Type 304.

D. Adjustable Anchors for Connecting to Concrete, CMU or Structural Steel:

1. Description: Two-piece adjustable veneer anchoring system.

   a. Anchors: Zinc alloy barrel, flanged head, screw and eye, with drilling threads suitable for structural substrate.
   b. Ties: Hot-dip galvanized, carbon-steel wire, 3/16 in (5 mm) pre-coated diameter, triangular shaped ties, size as required to provide maximum bond, not less than 2 in (50 mm).

2. Basis of Design:

   a. Heckmann Building Products, Inc.; POS-I-TIE Masonry Veneer Anchor System with Triangle Tie (with ThermalGrip CI Washers at Cavity Insulation).
   b. Hohmann & Bernard, Inc.; Thermal Concrete 2-Seal Wing Nut Adjustable Thermal Veneer Anchor (with Wing Nut Anchor at Cavity Insulation).

3. Basis of Design:

   a. Heckmann Building Products, Inc.; POS-I-TIE Masonry Veneer Anchor System with Seismic Triangle Wire Tie (with ThermalGrip CI Washers at Cavity Insulation).
   b. Hohmann & Bernard, Inc.; Thermal Concrete 2-Seal Wing Nut Adjustable Thermal Veneer Anchor with Seismic Hook to Accept Continuous Wire (with Wing Nut Anchor at Cavity Insulation).

E. Adjustable Masonry Veneer Anchors for Sheathed Steel Studs Walls:

1. Anchor Plate: Minimum 0.0713 in (14 gage) (1.81 mm) uncoated base metal thickness, with raised strap stamped vertically into center to provide a slot between strap and plate for interlocking wire tie, with one screw hole at top and one at bottom; with rubberized asphalt flexible flashing material either adhered to back of plate, or loose for separate mounting.
2. Wire Tie: Minimum 3/16 in (5 mm) diameter, bent into triangle shaped tie; length as required to extend at least halfway through masonry veneer but with minimum 5/8 in (15 mm) cover on outside face of masonry veneer.
3. Manufacturers and Products:

   a. Heckmann Building Products, Inc.; 315D Screw-On Anchor Plate with 316 Triangle Wire Ties.
   b. Hohmann & Barnard, Inc.; DW-10HS Veneer Anchor with Vee Byne-Tie.
   c. Prosoco; Masonry Veneer Tie (Anchor Plate and Wire Tie).
   d. Wire-Bond; Type III Screw-On Anchor 1004 with 1100 Series Triangular Wire Tie.

F. Adjustable Masonry Veneer Anchors for Sheathed Steel Studs Walls with Insulation in Cavity:

1. Anchor Plate: Minimum 0.0713 in (14 gage) (1.81 mm) uncoated base metal thickness, with projecting horizontal tabs of length to allow for insulation thickness, with holes or slots to receive pintel legs, with two screw holes; with rubberized asphalt flexible flashing material either adhered to back of plate, or loose for separate mounting.
2. Insulation Retainer: Manufacturer's standard designed to hold cavity insulation in place.
3. Wire Pintel: Minimum 3/16 in (5 mm) diameter, bent into open-end rectangle box shaped tie with 2 legs bent down to slip into anchor slot; length as required to extend at least halfway through masonry veneer but with minimum 5/8 in (15 mm) cover on outside face of masonry veneer.
4. Manufacturers and Products:
   a. Hohmann & Barnard, Inc.; HB-213-2X Adjustable Veneer Anchor (Anchor Plate, Insulation Retainer and Wire Pintel).
   b. Prosoco; Masonry Veneer Tie (Anchor Plate, Insulation Retainer and Wire Tie).
   c. Wire-Bond; RJ-711 Adjustable Veneer Anchor (2401 Anchor Plate, Insulation Retainer and 2402 Wire Pintel).

G. Seismic Adjustable Masonry Veneer Anchors for Sheathed Steel Studs Walls:

1. Anchor Plate: Minimum 0.1017 in (12 gage) (2.58 mm) uncoated base metal thickness, with projecting horizontal tabs, with holes or slots to receive pintel legs, with two screw holes; with rubberized asphalt flexible flashing material either adhered to back of plate, or loose for separate mounting.
2. Plate Pintel: Minimum 0.1017 in (12 gage) (2.58 mm) uncoated base metal thickness, with down-turned leg to slip into anchor slot; with punched shear lugs for holding pencil rod.
3. Pencil Rod: Deformed wire, 3/16 in (5 mm) in diameter.
4. Manufacturers and Products:
   a. Hohmann & Barnard, Inc.; HB-213-2X SIS Seismic Veneer Anchor (HB-213 Adjustable Veneer Anchor, Wire Pintel with Seismiclip Interlock System).
   b. Wire-Bond; RJ-721 Anchoring System (2421 Slotted Anchor Plate and 2422 Seismic Plate Pintel with Continuous Seismic Wire).

H. Seismic Adjustable Masonry Veneer Anchors for Sheathed Steel Studs Walls with Insulation in Cavity:

1. Anchor Plate: Minimum 0.1017 in (12 gage) (2.58 mm) uncoated base metal thickness, with projecting horizontal tabs of length to allow for insulation thickness, with holes or slots to receive pintel legs, with two screw holes; with rubberized asphalt flexible flashing material either adhered to back of plate, or loose for separate mounting.
2. Insulation Retainer: Manufacturer's standard designed to hold cavity insulation in place.
3. Plate Pintel: Minimum 0.1017 in (12 gage) (2.58 mm) uncoated base metal thickness, with down-turned leg to slip into anchor slot; with punched shear lugs for holding pencil rod.
4. Pencil Rod: Deformed wire, 3/16 in (5 mm) in diameter.
5. Manufacturers and Products:
   a. Hohmann & Barnard, Inc.; HB-213-2X SIS Seismic Veneer Anchor (HB-213 Adjustable Veneer Anchor, Insulation Retainer, Wire Pintel with Seismiclip Interlock System).
   b. Wire-Bond; RJ-721 Anchoring System (2421 Slotted Anchor Plate, Insulation Retainer and 2422 Seismic Plate Pintel with Continuous Seismic Wire).

I. Stack Bond Adjustable Masonry Veneer Anchors for Sheathed Steel Studs Walls:

1. Anchor Plate: Minimum 0.1017 in (12 gage) (2.58 mm) uncoated base metal thickness, with projecting horizontal tabs, with holes or slots to receive pintel legs, with two screw holes; with rubberized asphalt flexible flashing material either adhered to back of plate, or loose for separate mounting.
2. Plate Pintel: Minimum 0.1017 in (12 gage) (2.58 mm) uncoated base metal thickness, with down-turned leg to slip into anchor slot; with punched shear lugs for holding pencil rod.
3. Pencil Rod: Deformed wire, 3/16 in (5 mm) in diameter.
4. Manufacturers and Products:
    a. Hohmann & Barnard, Inc.; HB-213-2X SIS Seismic Veneer Anchor (HB-213 Adjustable Veneer Anchor, Wire Pintel with Seismiclip Interlock System).
    b. Wire-Bond; RJ-721 Anchoring System (2421 Slotted Anchor Plate and 2422 Seismic Plate Pintel with Continuous Seismic Wire).

J. Stack Bond Adjustable Masonry Veneer Anchors for Sheathed Steel Studs Walls with Insulation in Cavity:

1. Anchor Plate: Minimum 0.1017 in (12 gage) (2.58 mm) uncoated base metal thickness, with projecting horizontal tabs of length to allow for insulation thickness, with holes or slots to receive pintel legs, with two screw holes; with rubberized asphalt flexible flashing material either adhered to back of plate, or loose for separate mounting.
2. Insulation Retainer: Manufacturer's standard designed to hold cavity insulation in place.
3. Plate Pintel: Minimum 0.1017 in (12 gage) (2.58 mm) uncoated base metal thickness, with down-turned leg to slip into anchor slot; with punched shear lugs for holding pencil rod.
4. Pencil Rod: Deformed wire, 3/16 in (5 mm) in diameter.
5. Manufacturers and Products:
    a. Hohmann & Barnard, Inc.; HB-213-2X SIS Seismic Veneer Anchor (HB-213 Adjustable Veneer Anchor, Insulation Retainer, Wire Pintel with Seismiclip Interlock System).
    b. Wire-Bond; RJ-721 Anchoring System (2421 Slotted Anchor Plate, Insulation Retainer and 2422 Seismic Plate Pintel with Continuous Seismic Wire).

K. Irregular Bond/Coursing Adjustable Masonry Veneer Anchors for Walls with Insulation in Cavity:

1. Description: Two-piece adjustable veneer anchoring system.
    a. Anchors: Zinc alloy barrel, flanged head, screw and eye, with drilling threads suitable for structural substrate.
    b. Insulation Retainer: Manufacturer's standard designed to hold cavity insulation in place.
    c. Ties: Hot-dip galvanized, carbon-steel wire, 3/16 in (5 mm) pre-coated diameter, triangular shaped ties, size as required to provide maximum bond, not less than 2 in (50 mm).
2. Basis of Design:
    a. Heckmann Building Products, Inc.; POS-I-TIE Masonry Veneer Anchor System (with ThermalGrip CI Washers).
    b. Hohmann & Bernard, Inc.; Thermal Concrete 2-Seal Wing Nut Adjustable Thermal Veneer Anchor (with Wing Nut Anchor at Cavity Insulation).

L. Polymer-Coated Steel Drill Screws for Steel Studs:

1. Material Quality Standard: ASTM C 954.

2. Description: Self-drilling, hex washer head with bonded EPDM washer, screw of size and length required to penetrate steel stud flange by not less than 3 exposed threads; corrosion protective organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
3. Manufacturers and Products:
   a. Elco Construction Products; Dril-Flex with Stalgard finish.
   b. ITW Buildex; Teks Maxiseal with Climaseal finish.

2.14 MISCELLANEOUS ANCHORS

A. Dovetail Slots in Concrete for Shelf Angles: As specified in Division 03 Section Concrete Accessories unless indicated otherwise.

2.15 EMBEDDED FLASHING MATERIALS

A. Sheet Metal Flashing: Metal flashing to comply with SMACNA's Architectural Sheet Metal Manual and as follows:
   1. Material:
      a. Quality Standard: ASTM A 240 / A 240M or A 666, Type 304.
      b. Quality Standard: ASTM A 240 / A 240M or A 666, Type 316.
      c. Description: Stainless steel, 2D annealed finish, not less than 0.0250 in (24 ga) (0.64 mm) thick, unless noted otherwise.
   2. Solder:
      a. Material Quality Standard: ASTM B 32, Grade Sn60.
      b. Description: Solder with acid flux of type recommended by stainless steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.

B. Sealant for Sheet Metal Flashing: Exterior non-sag silicone sealant, Class 100/50, as specified in Division 07 Section Joint Sealants.

C. Sealant for Use at Concealed Joints: Contractor’s option, one of the following:
   1. Butyl: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
   2. Silicone: ASTM C 920, single-component, neutral cure silicone sealant.
      a. Basis of Design: Dow; Dowsil 758 Silicone Weather Barrier Sealant.

D. Rubberized-Asphalt Flexible Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.02 mm).
   1. Manufacturers and Products:
      a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
      b. Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
      c. GCP Applied Technologies; Perm-A-Barrier Wall Flashing.
      d. Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
      e. Hohmann & Barnard, Inc.; Textroflash.
      f. W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
      g. Polyguard Products, Inc.; Polyguard 400.
   2. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

3. Compatibility: Flexible flashing shall be compatible with air and water barrier and approved by air and water barrier manufacturer in writing.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.16 ACCESSORIES

A. Weeps and Vents: Provide one of the following:

1. Plastic Weep and Vent:

a. Description: One-piece flexible extrusion made from ultraviolet light resistant polypropylene copolymer, consisting of honeycomb matrix of multiple cells, designed to fill head joint with outside face held back 1/8 in (3 mm) from exterior face of masonry veneer.
b. Color: As selected by Architect from manufacturer's standard colors available.
c. Manufacturers and Products:

1) Advanced Building Products, Inc.; Mortar Maze Weep Vents.
2) Heckmann Building Products, Inc.; No. 85 Cell Vent.
3) Hohmann & Barnard, Inc.; QV - Quadro-Vent.
4) Wire-Bond; Cell Vent

2. Mesh Weep and Vent:

a. Description: Compressed, 200 denier polyester with 90 percent open mesh and bonded with flame retardant adhesive.
b. Color: As selected by Architect from manufacturer's standard colors available.
c. Basis of Design: Mortar Net USA, Ltd.; Mortar Net Weep Vents.

B. Cavity Drainage Material:

1. Description: Composed of either reticulated, nonabsorbent mesh made from polyethylene strands, or, polymer core geomatrix composed of woven nylon strands, molded and shaped in open weave configuration to maintain drainage at weeps without being clogged by mortar droppings, size as required to extend across entire width of cavity.
2. Manufacturers and Products:

a. Advanced Building Products, Inc.; Mortar Break II.
b. Heckmann Building Products, Inc.; No. 84 Weep-Thru Mortar Deflector.
c. Mortar Net USA, Ltd.; Mortar Net.
d. Polyguard Products, Inc.; Termi-Net.
e. Wire-Bond; Cavity Net II.

C. Bond Breaker Strips:

1. Material Quality Standard: ASTM D 226, Type I.
2. Description: Asphalt-saturated organic roofing felt (No. 15 asphalt felt).

D. Termination Bars: ASTM A 666, Type 304 formed stainless steel flat bars; 1 in by 1/8 in (25 mm by 3 mm) thick; predrilled at 8 in (200 mm) centers. No aluminum or plastic bars allowed.

1. Anchors: Same type screws as used to attach veneer wall ties.

E. Cavity Wall Insulation: As specified in Division 07 Section Thermal Insulation.

F. Barrier Sealing Tape: Air and water barrier sheet material laminated to adhesive coated rubberized asphalt or butyl. Refer to Division 07 Section Air and Water Barriers.

G. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity provided by waterproofing manufacturer.

H. Asphalt Mastic Dampproofing: Water-based, cold-applied, non-flammable, asphalt mastic emulsion with refined asphalt, non-asbestos mineral fibers, and clay fillers complying with ASTM D 1227, Type II, Class 1. Brush, roller, or trowel grade allowed. Include primer and accessories as required.

2.17 MASONRY VENEER CLEANERS

A. Commercial Cleaning Compounds: Products as recommended and approved by masonry veneer and mortar manufacturers.

1. Description: Manufacturer formulated, general purpose cleaner for removing mortar stains, efflorescence, and other construction related stains from new masonry veneer surfaces, with following suitability requirements:

a. Suitable for masonry veneer units and mortar installed, without discoloring or damaging masonry veneer materials.
b. Suitable for conditions at project site, including, but not limited to, windows, doors, other exterior wall elements, and adjacent walks or landscaping.

2. Manufacturers:

a. Diedrich Technologies, Inc.
b. EaCoChem.
c. Prosoco, Inc.

B. Cleaning Restrictions: Following methods are not permitted nor will they be allowed:

1. Hydrochloric acid.
2. Muratic acid.
3. Pressurized water blasting.
4. Abrasive blasting.

2.18 METAL FLASHING FABRICATION

A. Field Measurements: Where metal flashing is to fit, cope, or be tailored to other construction, check actual dimensions of other construction by accurate field measurements before fabrication of metal flashing.

B. Fabrication Procedures: Fabricate continuous flashings in sections 8 ft (2.4 m) long minimum, but not exceeding 12 ft (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.

1. Shop form flashing on a bending brake.
2. Shape, trim and hand seam on bench as far as practical with proper tools.
3. Form exposed metal Work without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated.
4. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.
5. Form materials to shape indicated with straight lines, sharp angles and smooth curves.
6. Fold and hem exposed edges of flashings.

C. Flashing Joinery: Fabricate interior and exterior corners, intersections, and complex flashing conditions in shop, rather than in field, with properly folded, constructed and continuous soldered joints. Field fabricated units are not permitted and will not be allowed.

2.19 MORTAR MIX

A. General: Mix cementitious materials in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency for minimum 3 minutes to 5 minutes; do not hand mix.

1. Admixture Limitation: Do not use admixtures including air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, calcium chloride or other admixtures, unless otherwise indicated.

a. Decorative Concrete Masonry Units: Use water-repellent admixture in the mortar for decorative concrete masonry units only.

2. Cementitious Limitation: Limit cementitious materials in mortar to Portland cement and lime.
3. Ingredient Measurement: Measure in a one cubic foot batching box before mixing for component materials not pre-blended, prepackaged or containerized.
4. Aggregate Moisture Content: Monitor moisture content of aggregates and exercise caution when mixing to avoid over or under-sanding of mortar.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project.

C. Mortar Mix:

1. Mix Quality Standard: ASTM C 270, Proportion Specification for Portland cement-lime mortars, Type N.
2. Mortar Color: Standard gray, unless indicated otherwise.
3. Colored Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required; limit mineral oxide pigments to maximum 10 percent of cement content by weight, and maximum 2 percent for carbon black pigment.
4. Colored Aggregate Mortar: Produce mortar of color required by use of colored aggregates in combination with selected cementitious materials.
5. Match Existing Mortar: Wherever "match existing" indicated, provide masonry mortar of matching color and texture as existing adjacent masonry veneer work.
6. Basis of Design: As scheduled or as indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Applicable portions of BIA Technical Notes on Brick Construction, if no other installation quality standard applies to condition.
2. TMS 602 and local building code requirements.
3. Respective manufacturer’s written installation instructions.
4. Accepted submittals.
5. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF MASONRY VENEER

A. Installation Performance Requirements: Ensure masonry cavity is properly isolated from building interior to prevent water infiltration from infiltrating out of masonry cavity into other components of building such as window and door jambs and building interiors.

B. Openings: Leave for equipment to be installed before completion of masonry veneer; after installation of equipment, complete masonry veneer to match construction immediately adjacent to opening.

C. Cutting: Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, un-chipped edges. Install cut units with cut surfaces and, where possible, cut edges concealed.

D. Blending of Masonry Veneer Units: Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed. If color blending is a critical aspect of Work, manufacturer shall provide instructions for blending.

E. Mortar Workability: Maintain by remixing or retempering; mortar with added color pigments shall not be re-tempered. Discard mortar that has begun to stiffen or is not used within 2.5 hours after initial mixing.

F. Match Existing Masonry Veneer: Match coursing and bonding of existing masonry veneer.

3.5 SHELF ANGLES AND LINTELS

A. Steel Shelf Angles: Erection as specified in Division 05 Section Metal Fabrications.

B. Steel Loose Lintels: Set where indicated or required, with not less than 8 in (200 mm) of bearing at each jamb, unless otherwise indicated.

C. Precast Concrete Lintels: Set where indicated, with not less than 8 in (200 mm) of bearing at each jamb, unless otherwise indicated.

D. Masonry Lintels: Construct in place using formwork and shoring of sufficient strength to support Work, until strength has been achieved and assembly is cured.

3.6 LAYING MASONRY VENEER WALLS

A. General: Lay out walls in advance for accurate spacing of surface bond patterns, uniform joint thicknesses, accurate location of openings, movement-type joints, returns, and offsets. Avoid using of less than half-size units at corners, jambs, and where possible at other locations.

B. Bond Patterns:

1. Exposed Masonry Veneer: Match coursing of existing masonry, unless otherwise indicated.
2. Exposed Masonry Veneer: One-half running bond or one-third running bond as indicated.
3. Exposed Masonry Veneer: Stack bond as indicated.

4. Concealed Masonry Veneer: Lay units in a wythe in running bond or bonded by lapping not less than 2 in (50 mm) lap.
5. Corners: Bond and interlock each course of each wythe. Do not use units with less than nominal 4 in (100 mm) horizontal face dimensions at corners or jambs.
6. Mitered corners are not allowed.

C. Stopping and Resuming Work: In each course, rack back one-half unit length for one-half running bond pattern or one-third unit for one-third running bond pattern; do not tooth. When resuming Work, clean masonry veneer surfaces that are to receive mortar, remove loose masonry veneer units and mortar.

D. Built-In Work:

1. As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry veneer around built-in items.
2. Fill space between steel frames and masonry veneer solidly with mortar, unless otherwise indicated.

3.7 MORTAR BEDDING AND JOINTING

A. General Procedures:

1. Do not disturb previously laid units.
2. Spread mortar for bed joint only so far ahead of laying units that mortar will be plastic when units are laid.
3. Butter end of unit with ample mortar so that head joint is completely filled with mortar when placed.
4. Do not deeply furrow bed joints or slush head joints.
5. Avoid over-plumbing and pounding of corners and jambs to fit stretcher unit after setting in place. Where adjustments must be made after initial setting, remove mortar and replace with fresh mortar.
6. Rock closures into place with both head joints and closure space spread with ample mortar. Place against adjacent units so that both horizontal and vertical joints are completely filled.

B. Mortar Joint Thickness: Minimum 3/8 in (10 mm) wide for head and bed joints.

C. Hollow Masonry Veneer Units: Lay with face shells fully bedded in mortar and with head joints of depth equal to bed joints; with entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

D. Solid Masonry Veneer Units: Lay with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and place into wall construction. Do not deeply furrow bed joints or slush head joints.

E. Joint Tooling: Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

1. Make mortar joints straight, clean, and uniform in thickness. Tool joints to produce dense surface well bonded to edges.
2. Joints which are not tight at time of tooling shall be raked out, pointed, and then tooled.
3. Tool when mortar is partially set but still sufficiently plastic to bond.
4. Use a tool which compacts mortar, pressing excess mortar out of joint rather than dragging it out.
5. Tool vertical joint first.

F. Stone and Cast-Stone Trim Units: Lay with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and place into wall construction. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with water.

1. Rake out mortar joints for pointing with sealant.
2. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Division 7 Section Joint Sealants.

3.8 MASONRY CAVITIES, WEEPS, AND VENTS

A. Cavity Cleaning: Keep cavity clean of mortar droppings and other materials. Strike joints facing cavity flush.

B. Mortar Protection: Install cavity drainage material at base of cavity to protect bottom of cavity from mortar droppings that would prevent weeps from draining infiltrated water.

C. Cavity Wall Insulation: As specified in Division 07 Section Thermal Insulation. In addition, install continuous strip of cavity insulation, minimum 3 in (75 mm) wide, at edges of cavities adjacent to jamb of through-wall openings.

D. Weeps: Install weeps at maximum 32 in (800 mm) on centers in head joints of first course of masonry veneer immediately above embedded flashings.

E. Vents: Install vents at maximum 32 in (800 mm) on centers in head joints of topmost course of masonry veneer immediately below shelf angles, and at top of each continuous cavity.

3.9 ANCHORING MASONRY VENEER

A. Adjustable Anchors for Connecting to Concrete, CMU or Structural Steel: Anchor masonry veneer to structural members where masonry veneer abuts or faces structural members to comply with following, with anchors embedded in masonry veneer joints and attached to structure:

1. Unless otherwise indicated, provide an open space not less than 1 in (25 mm) in width between back of masonry veneer and structural member. Keep open space free of mortar or other rigid materials.
2. Anchor masonry veneer to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors vertically and horizontally as required for coursing with one anchor for every 2 sq ft (1858 sq cm) of masonry veneer; stagger alternating anchors in each row.
4. Asphalt Mastic Dampproofing Substrate: Apply a coating of liquid membrane behind through-wall attachments that penetrate asphalt mastic dampproofing.
5. Sheet Membrane Substrate: Apply a coating of liquid membrane behind through-wall attachments that penetrate sheet membrane.

B. Adjustable Masonry Veneer Anchors for Sheathed Steel Studs Walls: Anchor masonry veneer to sheathed steel studs with proper anchors.

1. Unless otherwise indicated, provide an open space not less than 2 in (50 mm) in width between back of masonry veneer and face of sheathing or 1 in (25 mm) from face of cavity insulation.
2. Keep open space free of mortar or other rigid materials.
3. Locate anchor plate portion of wall tie to allow maximum vertical differential movement of tie up and down.
4. Space anchors at 16 in (400 mm) on center vertically and 16 in (400 mm) on center horizontally as required for coursing.
5. Install additional anchors within 12 in (300 mm) of openings and at maximum 8 in (200 mm) on center around perimeter.

6. Attach each anchor through sheathing to steel studs with 2 metal fasteners each.
   a. Air and Water Barrier: Install a strip of barrier flashing tape behind through-wall attachments that penetrate air and water barrier. Seal all penetrations with weather barrier sealant
7. Embed wall tie, in proper orientation, at least halfway through masonry veneer but with at least 5/8 in (15 mm) cover on outside face of masonry veneer.
8. Seismic Anchors and Ties: Install pencil rod continuous horizontally.
9. Stack Bond Anchors and Ties: Install pencil rod continuous horizontally.

3.10 EMBEDDED FLASHINGS

A. General: Drawings may not necessarily indicate or describe full extent of Work required for completion of embedded flashing.

B. Reglets and Nailers: Install for flashing and other related construction where they are shown to be built into masonry.

C. Scheduled Locations: In addition to conditions shown on Drawings, install embedded flashings within masonry cavity at following locations to direct downward flow of infiltrated water within cavity to exterior:

1. Shelf angles with end dams at through-wall openings; and with lap joints.
2. Lintels with end dams or laps.
3. Jambs at through-wall openings, full height from sill to head.
4. Other obstructions.

D. Preparation: Substrate surfaces shall be smooth and free from projections that could puncture flashing.

E. Flashing Installation: Provide continuous support for flashings and ensure positive drainage to exterior.

1. Install sheet metal flashing true to line and levels indicated; minimize quantity of lap joints by using longest units possible.
2. Set shaped sheet metal units in proper locations with outside hemmed edges flush with building face location indicated; attach cavity side flanges to sheathed steel stud wall with screw fasteners driven into studs.
3. At continuous shelf angles, terminate horizontal flashings at through-wall openings with properly folded and constructed sheet metal end dams with a depth equivalent to one masonry veneer course, with continuous soldered joints.
4. At lintels, terminate horizontal flashings at end of lintel with properly folded and constructed sheet metal end dams with a depth equivalent to one masonry veneer course, with continuous soldered joints.
5. At lap joints of horizontal flashings, form neat and aligned joints by interlocking splice plate within hemmed edge of sheet metal flashing profile; apply sealant and rubberized asphalt flashing as indicated to create water-resistant joint.
6. Set shaped sheet metal units at jambs of through-wall openings and lap inside of end dams at horizontal flashings below; coordinate installation with rigid cavity insulation.
7. Seal cavity edges of sheet metal flashings within masonry cavity to sheathing with continuous rubberized asphalt flashing.

F. Examination and Repair: Immediately prior to laying masonry veneer, examine exposed surfaces of flashing and seal penetrations and damaged areas with rubberized asphalt flashing material before covering with masonry veneer.

G. Asphalt Mastic Dampproofing Application: Apply continuous layer of product, without pinholes or holidays, at below grade masonry veneer locations and as indicated on drawings. Apply at coverage rate instructed by manufacturer.

1. Repair voids and damage. Patch with additional layer of asphalt mastic dampproofing extending 6 in (150 mm) beyond repaired areas in all directions.

3.11 MASONRY VENEER EXPANSION JOINTS

A. General: Install masonry veneer expansion joints materials as Work progresses. Do not allow materials to span masonry veneer expansion joints without provision to allow for in-plane wall or partition movement. Maintain joints free and clear of mortar.

B. Vertical Expansion Joints:

1. Locate where indicated but not to exceed 25 ft (7.6 m) on center, and within 10 ft (3 m), 4 ft (1.22 m) preferred, of each side of outside corner. Keep vertical joints straight, true, and continuous from top to bottom of masonry veneer.
2. Form open joint of width indicated for installation of sealant and backer rod specified in Division 07 Section “Joint Sealants”.

C. Horizontal Joints: Build in horizontal pressure-relieving joints below shelf angles and where indicated; construct of width required for installation of sealant and backer rod specified in Division 07 Section “Joint Sealants. Locate not less than 3/8 in (9 mm) wide horizontal pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.12 INSTALLATION TOLERANCES

A. Conspicuous Lines:

1. Vertical: For such conditions as external corners, door and window jambs, reveals, and masonry veneer expansion joints, maximum variation of the following from plumb:

a. 1/8 in (3 mm) in 10 ft (3 m).
b. 1/4 in (6 mm) in 20 ft (6 m).
c. 1/2 in (12 mm) overall.

2. Horizontal: For such conditions as exposed lintels, sills, door and window heads, parapets, and reveals, maximum variation of the following from level:

a. 1/8 in (3 mm) in 10 ft (3 m).
b. 1/4 in (6 mm) in 20 ft (6 m).
c. 1/2 in (12 mm) overall.

B. Exposed Head Joints:

1. Vertical Alignment: Maximum variation of the following from plumb:

a. 1/4 in (6 mm) in 10 ft (3 m).
b. 1/2 in (12 mm) from plumb top to bottom of wall.

2. Thickness: Maximum variation from width indicated of plus or minus 1/8 in (3 mm); maximum variation from adjacent bed joint and head joint thicknesses 1/8 in (3 mm).

C. Exposed Bed Joints: Maximum variation from width indicated of plus or minus 1/8 in (3 mm), with a maximum thickness limited to 1/2 in (12 mm); maximum variation from bed joint thickness of adjacent courses of 1/8 in (3 mm).

D. Flush Alignment: Maximum variation of 1/16 in (1.5 mm) except due to warpage of masonry veneer units with tolerances specified for warpage of units.

E. Stack Bond: For exposed head joints and bed joints, maximum variation from a straight line of 1/16 in (1.5 mm) from one masonry veneer unit to next.

3.13 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections and prepare reports:

1. Special inspections in accordance with TMS 402/602 and the Building Code.
2. Testing agency will report test results promptly and in writing to Contractor and Architect.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.14 ADJUSTING

A. Repairs for Damage: Remove and replace masonry veneer units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units and install fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During tooling of joints, enlarge any voids or holes, except weeps and vents, and completely fill with mortar. Point up all joints including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants, where indicated.

3.15 CLEANING

A. In-Progress Cleaning: As soon as practical, clean masonry veneer as Work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.

B. Protection: Prior to Final Cleaning, protect surrounding areas, landscaping, adjacent surfaces, and vehicles from contact with cleaning products.

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry veneer as follows:

1. Protect adjacent and nearby materials, especially windows and glass, to avoid damage.
2. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
3. Test cleaning methods on mock-ups; leave one half of panel uncleaned for comparison purposes. Obtain Architect’s approval of sample cleaning before proceeding with cleaning of permanent masonry veneer.
4. Clean masonry veneer by means recommended by cleaning product manufacturer using masonry cleaner compound as recommended and approved by masonry veneer and mortar manufacturers.
5. Avoid drifting of cleaning spray caused by wind.

3.16 MASONRY VENEER FINISH SCHEDULE

A. Face Brick Masonry Unit - Basis of Design: MVXX

1. Manufacturer:
2. Product Series:
3. Color Name and Number:
4. Face Style:
5. Color Selection:
6. Size (Actual Dimensions)

a. Unit Designation: Standard.
b. Width: 3-1/2 in to 3-5/8 in (89 mm to 92 mm).
c. Height: 2-1/4 in (56 mm).
d. Length: 7-5/8 in (190 mm).
e. Vertical Coursing: 3 within 8 in (200 mm).

7. Bond Pattern:

B. Calcium Silicate Masonry Unit - Basis of Design: MVXX

1. Manufacturer:
2. Product Series:
3. Color Name and Number:
4. Face Style:
5. Color Selection:
6. Size (Actual Dimensions)

a. Width: 3-5/8 in (92 mm).
b. Height: 7-5/8 in (190 mm).
c. Length: 15-5/8 in (390 mm).

7. Bond Pattern:

C. Decorative Concrete Masonry Units - Basis of Design: MVXX

1. Manufacturer:
2. Product Series:
3. Color Name and Number:
4. Face Texture:
5. Size (Actual Dimensions)

a. Width: 3-5/8 in (92 mm).
b. Height: 7-5/8 in (190 mm).
c. Length: 15-5/8 in (390 mm).

6. Bond Pattern: One-Half Running Bond.

D. Pre-Faced Concrete Masonry Units - Basis of Design: MVXX

1. Manufacturer:
2. Product Series:
3. Color Name and Number:
4. Face Texture:
5. Size (Actual Dimensions): Manufactured to dimensions indicated below, but with pre-faced surfaces having 1/16 in (1.5 mm) wide returns of facing to create 1/4 in (6 mm) wide mortar joints with modular coursing.

a. Width: 3-5/8 in (92 mm).
b. Height: 7-5/8 in (190 mm).

c. Length: 15-5/8 in (390 mm).

6. Bond Pattern:

E. Natural Stone Masonry Units - Basis of Design: MVXX

1. Manufacturer / Quarry:
2. Product Series:
3. Color Name and Number:
4. Face Style:
5. Color Selection:
6. Size (Actual Dimensions)

a. Width: 3-5/8 in (92 mm).
b. Height: 7-5/8 in (190 mm).
c. Length: 15-5/8 in (390 mm).
d.

F. Cast Stone Masonry Units - Basis of Design: MVXX

1. Manufacturer / Quarry:
2. Product Series:
3. Color Name and Number:
4. Face Style:
5. Color Selection:
6. Size (Actual Dimensions)

a. Width: 3-5/8 in (92 mm).
b. Height: 7-5/8 in (190 mm).
c. Length: 15-5/8 in (390 mm).

G. Mortar Color - Basis of Design: Use with MVXX.

1. Manufacturer:
2. Product Series:
3. Color Name and Number:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 042200
CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Single wythe concrete unit masonry and supplementary items necessary for installation.

1.2 DEFINITIONS

A. Load-Bearing Masonry: Masonry containing reinforcing steel in grouted cells for load-bearing assemblies designed by Structural Engineer to support axial (gravity) loads and lateral (wind/seismic) loads.

B. Masonry Terminology: Refer to NCMA TEK 1-4 and other referenced quality standards.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each type of product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of construction, including dimensioned drawings, plans, elevations, sections, and details of components to be incorporated into Work including, but not limited to, the following:

1. Flashing: Large-scale details for each element of flashing system showing layout, profiles, methods of joining, and anchorage details; including lintel units, shelf units, corner units, end dam units, conditions showing interface and relationship to adjacent materials, and other special applications.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced masonry assemblies.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification Purposes: Submit samples for each item listed below of size and construction indicated. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Decorative Concrete Masonry Units: Full-size samples for each different unit indicated.
2. Pre-faced Concrete Masonry Units: Full-size samples for each different unit indicated.
3. Pigmented and Colored-Aggregate Mortar: Samples using same sand and mortar ingredients to be used on Project; label samples to indicate types and amounts of pigments used.
4. Accessories: Samples of manufactured products, including anchors, ties, cavity drainage material, flashing materials, and other accessories.
5. Flashing: Samples of each shape, profile, intersection and transition required, not less than 12 in (300 mm) long, including end dam, and splice/lap joint for lintel/shelf angle flashing; demonstrate soldering quality.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

   a. Include data on material properties.
   b. For masonry units, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellant used in CMU.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures, if any.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 402/602.

E. Field Quality Control Reports: Written report of testing and inspection required by “Field Quality Control”.

1.5 QUALITY ASSURANCE

A. Hot and Cold Weather Work Plan: Written plan detailing methods, materials and equipment to be used to comply with weather requirements.

B. Masonry Cleaning Plan: Based on technical information provided by respective manufacturer for each masonry unit to be cleaned, prepare written plan for cleaning exposed masonry surfaces, prepared by commercial cleaning compound manufacturer, with signature of installer indicating acceptance and include following information:

1. Qualifications of applicators.
2. Products to be used and application procedures.
3. Masonry surfaces to be cleaned and required preparations.
4. Environmental requirements by authorities having jurisdiction for use and discharge of cleaning effluents.
5. Protection of surrounding areas, landscaping, and building surfaces adjacent to area of cleaning.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Label pallets of masonry units with manufacturers name, product name, and information required to identify products.

B. Storage:

1. Masonry Units: Store on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
2. Cementitious Materials: Store on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
3. Aggregates: Store where grading and other required characteristics can be maintained and contamination avoided.
4. Accessories: Store to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection during Work: Prevent excess moisture from entering Work in progress.

1. Cover tops of walls, projections, and sills with water-repellent tarps or heavy plastic sheets at end of each day's Work.
2. Cover partially completed masonry when construction is not in progress.
3. Extend cover minimum of 24 in (600 mm) down both sides and hold cover securely in place.
4. Protect door and window frames from damage.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.

1. Do not apply when ambient temperature is less than 32 deg F (0 deg C) or when 40 deg F (4.4 deg C) or less and falling.
2. Provide heat and protection (temporary or permanent) as required to protect Work from freezing for not less than 48 hours after application.
3. Distribute heat uniformly to prevent concentration of heat near sources; provide deflection or protective screens.
4. Use liquid cleaning methods only when air temperature is 40 deg F (4.4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

1. Protect Work against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial.
2. Apply and cure work as required by climatic and job conditions to prevent dryout during cure period.
3. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within ranges accepted for these characteristics.

C. Cementitious Materials: Obtain cementitious ingredients of a uniform quality, including color, for each component.

2.3 MASONRY UNITS, GENERAL

A. Masonry Standard: Comply with TMS 402/602 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

C. Special Shapes: Provide shapes indicated and as follows for each form of masonry unit required:

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. At interior locations, provide bullnosed units for outside exposed corners, unless otherwise indicated.
3. At exterior locations, provide square-edged units for outside exposed corners, unless otherwise indicated.

D. Match Existing Masonry: Wherever "match existing" indicated, provide masonry unit of matching color, texture, and size as existing adjacent masonry work.

2.4 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Load Bearing Masonry:

1. Provide reinforced masonry that develops net-area compressive strengths (f'm) at 28 days as indicated on Structural Drawings.
2. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with Tables 1 and 2 in TMS 402/602.

C. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119/NFPA 251/ UL 623 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

D. Regulatory Requirements: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:

1. TMS 402/602:

a. Maintain one copy of the standard in Project field office at all times during construction. Contractor's supervisory personnel are to be thoroughly familiar with this material as it applies to Project.

2.5 CONCRETE MASONRY UNITS (CMU)

A. Product Quality Standard: ASTM C 90, with following physical properties:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Interior Location Weight Classification: Lightweight, unless otherwise indicated.
3. Exterior Location Weight Classification: Medium weight, unless otherwise indicated.
4. Normal Weight Classification: Normal weight as required for finish indicated.
5. Size (Width): Manufactured to dimensions 3/8 in (10 mm) less than nominal dimensions.
6. Exposed Faces: Manufacturer standard.
7. Faces to Receive Direct Bonded Portland Cement Plaster: Provide coarse textured face units made with gap-graded aggregates.

2.6 DECORATIVE CONCRETE MASONRY UNITS

A. Product Quality Standard: ASTM C 90, with following minimum physical properties:

1. Unit Compressive Strength: Minimum average net-area compressive strength of 1900 psi (13.1 MPa) for 3 units, and minimum 1700 psi (11.7 MPa) for individual unit.
2. Weight Classification: Medium weight.

B. Integral Water Repellent: Provide units made with integral water repellent.

1. Description: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on back of test specimen.
2. Manufacturers and Products:

a. Addiment Inc.; Block Plus W-10.
b. Grace Construction Products; Dry-Block.

C. Basis of Design: As scheduled or as indicated in Design Selections.

D. Special Shapes: In addition to standard shapes, provide special shapes, such as corners, edge corners, and end edge corners, as required by conditions.

2.7 PRE-FACED CONCRETE MASONRY UNITS

A. Product Quality Standard: ASTM C 90, with manufacturer's standard smooth resinous facing complying with ASTM C 744, with following physical properties:

1. Unit Compressive Strength: Units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) for 3 units, and minimum 1700 psi (11.7 MPa) for individual unit.
2. Weight Classification: Lightweight.

B. Basis of Design: As scheduled or as indicated in Design Selections.

C. Special Shapes: In addition to standard shapes, provide special shapes, such as corners, edge corners, and end edge corners, as required by conditions.

2.8 ACOUSTICAL CONCRETE MASONRY UNITS

A. Product Quality Standard: ASTM C 90, with manufacturer's standard smooth resinous facing complying with ASTM C 744, with following physical properties:

1. Unit Compressive Strength: Units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) for 3 units, and minimum 1700 psi (11.7 MPa) for individual unit.
2. Weight Classification: Lightweight.

B. Basis of Design: As scheduled or as indicated in Design Selections.

2.9 LINTELS

A. Steel Angle Lintels: Materials complying with Division 05 Section Metal Fabrications for loose masonry lintels (Designation MF), with schedule as shown on the Drawings.

B. Cast-in-Place Concrete Lintels: Concrete materials complying with Division 03 Section Cast-in-Place Concrete for color, texture, and compressive strength indicated or required, and with reinforcing bars to support loads indicated.

C. Precast Concrete Lintels: As specified in Division 03 Section Architectural Precast Concrete.

D. Masonry Lintels: Prefabricated or built-in-place masonry lintels as shown of the Drawings made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure prefabricated lintels before handling and installing.

2.10 FIREPLACE AND CHIMNEY LINING UNITS

A. Firebox Brick: ASTM C 1261, size required to produce lining thickness indicated.

B. Clay Flue Lining Units: ASTM C 315.

2.11 MORTAR AND GROUT MATERIALS

A. Portland Cement:

1. Material Quality Standard: ASTM C 150, Type I; except Type III may be used for cold-weather construction.
2. Color: Natural gray color or white cement as required to produce mortar color required.
3. Manufacturers:

a. LafargeHolcim.
b. Lehigh Cement Co.
c. Lone Star Industries, Inc.
d. Rinker Materials.
e. Royal White Cement.

4. Types of Cements Not permitted:

a. Masonry Cement: ASTM C 91.
b. Mortar Cement: ASTM C 1329.

B. Hydrated Lime:

1. Material Quality Standard: ASTM C 207, Type S.
2. Manufacturers:

a. Graymont Dolime (OH) Inc.
b. Rockwell Lime Co.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Standard Gray Mortar:

1. Product Quality Standard: ASTM C 144.
2. Mortar Exposed to View: Use washed aggregate consisting of natural sand or crushed stone.
3. Joints Less Than 1/4 in (6 mm) Thick: Use aggregate graded with 100 percent passing the No. 16 (1.18 mm) sieve.

E. Aggregate for White Mortar: Natural white sand or crushed white stone necessary to produce required mortar color.

F. Aggregate for Colored-Mortar: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Quantity Limitations: Pigments shall not exceed 10 percent of Portland cement by weight for mineral oxides or 2 percent for carbon black.
2. Manufacturers and Products:

a. Bayer Corp., Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
b. Davis Colors; True Tone Mortar Colors.
c. Solomon Grind-Chem Service, Inc.; SGS Mortar Colors.

H. Colored Portland Cement-Lime Mix: Packaged blend made from Portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Quantity Limitations: Pigments shall not exceed 10 percent of Portland cement by weight or 2 percent for carbon black.
2. Manufacturers and Products:

a. Capital Materials Corp.; Riverton Portland Cement Lime Custom Color.
b. Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
c. LafargeHolcim; Eaglebond.
d. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

I. Aggregate for Grout: ASTM C 404.

J. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.

K. Water-Repellent Admixture:

1. Description: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
2. Manufacturers and Products:

a. Addiment Inc.; Mortar Tite.
b. Grace Construction Products; Dry-Block Mortar Admixture.
c. Master Builders, Inc.; Color Cure Mortar Admix or Rheomix Rheopel.

L. Water: Potable, clean and free of amounts of oils, acids, alkalies, salts, organic materials, or other substances that are deleterious to mortar or any metal within the wall.

2.12 JOINT REINFORCEMENT

A. Masonry Joint Reinforcement, General:

1. Product Quality Standard: ASTM A 951 / A 951M.
2. Interior Walls: Mill galvanized, carbon steel, ASTM A 641 / A 641M.
3. Exterior Walls: Hot-dip galvanized, carbon steel, ASTM A 82 / A 82M with ASTM A 153 / A 153M, Class B-2 coating.
4. Wire Size for Side Rods: 0.148 in (3.77mm) diameter or as indicated.
5. Wire Size for Cross Rods: 0.148 in (3.77mm) diameter or as indicated.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 in (400 mm) on centers.
7. Lengths: Not less than 10 ft (3 m), with prefabricated corner and tee units.

B. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

C. Masonry Joint Reinforcement for Multi-Wythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing veneer wythe.

a. Ties shall have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall.
b. Ties shall extend at least halfway through facing veneer wythe but with at least 5/8 in (15 mm) cover on outside face.
c. Ties shall have hooks or clips to engage a continuous horizontal wire in the facing veneer wythe.

D. Manufacturers:

1. Heckmann Building Products, Inc.
2. Hohmann & Barnard, Inc.
3. Wire-Bond.

2.13 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars Product Quality Standard: ASTM A 615 / A 615M or ASTM A 996 / A 996M, Grade 60 (Grade 420). Sizes as indicated on the Drawings.

2.14 ANCHORS AND TIES

A. Materials:

1. Interior Walls:

a. Mill Galvanized, Carbon Steel Wire, ASTM A 82 / A 82M with ASTM A 641 / A 641M, Class 1 coating.
b. Galvanized Steel Sheet, ASTM A 653 / A 653M, Commercial Steel, G60 (Z180) zinc coating.

2. Exterior Walls:

a. Hot-Dip Galvanized, Carbon Steel Wire: ASTM A 82 / A 82M with ASTM A 153 / A 153M, Class B-2 coating.
b. Steel Sheet, Galvanized after Fabrication: ASTM A 1008 / A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153 / A 153M.

B. Sizes and Thicknesses: If not indicated below, as shown on Drawings, required by building code, or required by TMS 602.

C. Adjustable Anchors for Connecting to Concrete or Structural Steel:

1. Description: Two-piece adjustable veneer anchoring system.

a. Anchors: Zinc alloy barrel, flanged head, screw and eye, with drilling threads suitable for structural substrate.
b. Ties: Hot-dip galvanized, carbon-steel wire, 3/16 in (5 mm) pre-coated diameter, triangular shaped ties, size as required to provide maximum bond, not less than 2 in (50 mm).

2. Basis of Design: Heckmann Building Products, Inc.; "POS-I-TIE Masonry Veneer Anchor System".

D. Adjustable Anchors for Connecting to Structural Steel Framing: Anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4 in (6 mm) diameter wire.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 in (25 mm) of masonry face.

E. Adjustable Anchors for Connecting to Concrete: Anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 in (25 mm) of masonry face.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 in (38 mm) wide by 1/4 in (6 mm) thick by 24 in (600 mm) long, with ends turned up 2 in (50 mm) or with cross pins, unless otherwise indicated, or bent to configuration indicated.

2.15 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler:

1. Product Quality Standard: ASTM D 1056, Grade 2A1.
2. Description: Pre-molded filler strips formulated from neoprene; compressible up to 35 percent; of width and thickness indicated.

B. Pre-formed Control Joint Gaskets:

1. Product Quality Standard: ASTM D 2000, Designation M2AA-805.
2. Description: Formed from styrene-butadiene-rubber compound designed to fit standard sash block to maintain lateral stability in masonry wall.

C. Bond Breaker Strips:

1. Product Quality Standard: ASTM D 226, Type I.
2. Description: Asphalt-saturated, organic roofing felt (No. 15 asphalt felt).

D. Reinforcing Bar Positioners:

1. Description: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142 in (3.6 mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
2. Manufacturers and Products:

a. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
b. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.

c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

E. Cavity Wall Insulation: As specified in Division 07 Section "Thermal Insulation".

2.16 MASONRY CELL INSULATION

A. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.

1. Manufacturers and Products:

a. Concrete Block Insulating Systems; Korfil.
b. Shelter Enterprises Inc.; Omni Core.

B. Loose-Fill Insulation: Cellulosic-fiber loose-fill insulation, ASTM C 739, chemically treated for flame-resistance, processing, and handling characteristics.

C. Foamed-In-Place Cementitious Insulation: Two-component system consisting of polymeric resin and foaming catalyst, ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 0 5 25 75 and 5 100 450, respectively per ASTM E 84; and rated Class A (non-combustible) per ASTM E 136.

1. Basis of Design: Air Krete, Inc.
2. Minimum density of 2.0 lb/cu. ft. (32 kg/cu. m), R-Value of 3.9 per in (25 mm) of thickness per ASTM C 518.

D. Foamed-In-Place Polyurethane Insulation: Two-component system consisting of resin and catalyst, ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively per ASTM E 84; and rated Class A (non-combustible) per ASTM E 136.

1. Manufacturers and Products:

a. cfiFoam, Inc.; Core Foam.
b. C.P. Chemical Co.; Tripolymer Foam Insulation.
c. Polymaster, Inc.; R-501 Foamed-in-Place Insulation.
d. Tailored Chemical Products, Inc.; Core-Fill 500.
e. Thermal Corporation of America; Thermo Foam.

2. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

2.17 MASONRY CLEANERS

A. Commercial Cleaning Compounds:

1. Description: Manufacturer formulated, general purpose cleaner for removing mortar stains, efflorescence, and other construction related stains from new masonry surfaces, with following suitability requirements:

a. Suitable for masonry units and mortar installed, without discoloring or damaging masonry materials.
b. Suitable for the conditions at the project site, including, but not limited to, windows, doors, other exterior wall elements, and adjacent walks or landscaping.

2. Manufacturers:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

B. Cleaning Restrictions: Following methods are not permitted, nor will they be allowed:

1. Hydrochloric acid.
2. Muratic acid.
3. Pressurized water blasting.
4. Abrasive blasting.

2.18 MORTAR AND GROUT MIXES

A. General: Mix cementitious materials in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency for minimum 3 minutes to 5 minutes; do not hand mix.

1. Admixture Limitation: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, calcium chloride, or other admixtures, unless otherwise indicated.

a. Decorative Concrete Masonry Units: Use water-repellent admixture in the mortar for decorative concrete masonry units only.

2. Cementitious Limitation: Limit cementitious materials in mortar and grout to Portland cement and lime.
3. Ingredient Measurement: Measure in a one cubic foot batching box before mixing for component materials not pre-blended, prepackaged or containerized.
4. Aggregate Moisture Content: Monitor moisture content of aggregates and exercise caution when mixing to avoid over or under-sanding of the mortar.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project.

C. Mortar Mix:

1. Mix Quality Standard: ASTM C 270, Proportion Specification for portland cement-lime mortars, Types as follows for applications stated unless another type is indicated:

a. Non-Load-Bearing (Non-Reinforced) Masonry: Type N.
b. Load-Bearing (Reinforced) Masonry: Type S.
c. Other Applications: Type N where another type is not indicated.

2. Mortar Color: Standard gray, unless indicated otherwise.

a. Location: Interior, standard concrete masonry units.

3. Colored Pigmented Mortar for Decorative or Pre-Faced CMU: Select and proportion pigments with other ingredients to produce color required; limit mineral oxide pigments to maximum 10 percent of cement content by weight, and maximum 2 percent for carbon black pigment.
4. Colored Aggregate Mortar for Decorative or Pre-Faced CMU: Produce mortar of color required by use of colored aggregates in combination with selected cementitious materials.
5. Match Existing Mortar: Wherever "match existing" indicated, provide masonry mortar of matching color and texture as existing adjacent masonry veneer work.
6. Basis of Design: As scheduled or as indicated in Design Selections.

D. Grout for Unit Masonry:

1. Product Quality Standard: ASTM C 476.
2. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 402/602 for dimensions of grout spaces and pour height.
3. Use fine grout in grout spaces less than 2 in (50 mm) in horizontal dimension.

4. Use course grout in grout spaces 2 in (50 mm) or more in least horizontal dimension.
5. Provide grout with a slump of 8 to 11 in (200 to 275 mm) as measured according to ASTM C 143 / C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. TMS 602 and local building code requirements.
2. Applicable portions of NCMA TEK's.
3. Respective manufacturer's written installation instructions.
4. Accepted submittals.
5. Contract Documents.
6. PCA - Concrete Masonry Handbook, if no other installation quality standard applies to condition.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF CONCRETE UNIT MASONRY

A. Thickness: Build single-wythe masonry walls to actual widths of masonry units, using units of widths indicated.

B. Chases and Recesses: Build to accommodate items specified in this and other Sections.

C. Openings: Leave for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Cutting: Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Blending of Masonry Units: Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed. If color blending is a critical aspect of Work, manufacturer shall provide instructions for blending.

F. Mortar Workability: Mortar with added color pigments shall not be retempered. Discard mortar that has begun to stiffen or is not used within 2.5 hours after initial mixing.

G. Match Existing Masonry Veneer: Match coursing and bonding of existing masonry veneer.

3.5 SHELF ANGLES AND LINTELS

A. Steel Shelf Angles: Erection as specified in Division 05 Section "Metal Fabrications".

B. Steel Loose Lintels: Set where indicated or required, with not less than 8 in (200 mm) of bearing at each jamb, unless otherwise indicated.

C. Precast Concrete Lintels: Set where indicated, with not less than 8 in (200 mm) of bearing at each jamb, unless otherwise indicated.

D. Masonry Lintels: Construct in place using formwork and shoring of sufficient strength to support Work, until strength has been achieved and assembly is cured.

3.6 LAYING MASONRY WALLS

A. General: Lay out walls in advance for accurate spacing of surface bond patterns, uniform joint thicknesses, accurate location of openings, movement-type joints, returns, and offsets. Avoid using less than half-size units at corners, jambs, and, where possible at other locations.

B. Bond Pattern for Exposed Masonry:

1. Exposed Masonry: Unless otherwise indicated, lay units in a wythe with all units in one-half running bond.
2. Exposed Masonry: Stack bond.
3. Concealed Masonry: Lay units in a wythe in running bond or bonded by lapping not less than 4 in (100 mm) lap.
4. Corners: Bond and interlock each course of each wythe. Do not use units with less than nominal 8 in (200 mm) horizontal face dimensions at corners or jambs.
5. Provide scheduled finish on all exposed surfaces, including corner units.
6. Mitered corners are not allowed.

C. Stopping and Resuming Work: In each course, rack back appropriate unit length for bond pattern; do not tooth. When resuming Work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar.

D. Built-in Work:

1. As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
2. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
3. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

E. Concrete Masonry Cores under Loads: Fill cores in hollow concrete masonry units with grout 24 in (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

F. Top of Fire-Rated Partitions: Treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems".

3.7 MORTAR BEDDING AND JOINTING

A. General Procedures:

1. Do not disturb previously laid units.
2. Spread mortar for bed joint only so far ahead of laying units that mortar will be plastic when units are laid.

3. Butter end of unit with ample mortar so that head joint is completely filled with mortar when placed.
4. Do not deeply furrow bed joints or slush head joints.
5. Avoid over-plumbing and pounding of corners and jambs to fit stretcher unit after setting in place. Where adjustments must be made after initial setting, remove mortar and replace with fresh mortar.
6. Rock closures into place with both head joints and closure space spread with ample mortar. Place against adjacent units so that both horizontal and vertical joints are completely filled.

B. Mortar Joint Thickness: Minimum 3/8 in (10 mm) wide for head and bed joints.

C. Hollow Concrete Masonry Units: Lay as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

D. Solid Concrete Masonry Units: Lay with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

E. Firebox Brick: Lay in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately 1/8 in (3 mm). Tool joints smooth on surfaces exposed to fire or smoke.

F. Clay Flue Liners: Install to comply with ASTM C 1283. Install flue liners ahead of surrounding masonry. Set clay flue liners in full bed of refractory mortar 1/16 to 1/8 in (1.5 to 3 mm) thick. Strike joints flush on inside of flue to provide smooth surface. Maintain expansion space between flue liner and surrounding masonry except where surrounding masonry is required to provide lateral support for flue liners.

G. Joint Tooling: Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

1. Make mortar joints straight, clean, and uniform in thickness. Tool joints to produce dense surface well bonded to edges.
2. Joints which are not tight at time of tooling shall be raked out, pointed, and then tooled.
3. Tool when mortar is partially set but still sufficiently plastic to bond.
4. Use a tool which compacts mortar, pressing excess mortar out of joint rather than dragging it out.
5. Tool vertical joint first.

H. Joints at Direct Applied Finishes: Cut joints flush for masonry walls to receive Portland cement plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.8 MASONRY CAVITY WALLS

A. General: Refer to Division 04 Section "Masonry Veneer" for cavity wall requirements.

B. Thickness: Build multi-wythe masonry cavity walls to full thickness shown.

3.9 MASONRY CELL INSULATION

A. Molded-Polystyrene Insulation: Install units into masonry unit cells before laying units.

B. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

1. For cellulosic-fiber loose-fill insulation, comply with CIMA's Bulletin #2, "Standard Practice for Installing Cellulose Insulation".
2. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

C. Foamed-in-Place Insulation: Fill open cells and voids within masonry unit cells with foam insulation.

1. Use one of following techniques:

a. Top-Fill Technique: Use an extension tube to begin installing foam from bottom of cells, withdrawing extension tube as foam fills cavity.
b. Pressure Injection Technique: Drill small holes in each masonry unit, typically 5/8 in (15 mm) to 7/8 in (21 mm) in diameter, at an approximate height of 4 ft (1.2 m) from finished floor.

2. Inject foam insulation until it completely fills each vertical cell, evidenced by foam exiting adjacent injection hole. Repeat as needed until wall is completely filled.
3. After foam insulation sets, remove excess from outside of cavity.
4. Patch holes with mortar to resemble existing surface.
5. Protect foam insulation from excess moisture during initial 24 hour curing period after installation.

3.10 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 in (15 mm) on exterior side of walls, 1/2 in (12 mm) elsewhere. Lap reinforcement a minimum of 6 in (150 mm).

1. Space reinforcement not more than 16 in (400 mm) on centers.
2. Space reinforcement not more than 8 in (200 mm) on centers in parapet walls.
3. Provide reinforcement not more than 8 in (200 mm) above and below wall openings and extending 12 in (300 mm) beyond openings.

B. Installation Conditions:

1. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
2. Provide continuity at wall intersections by using prefabricated T-shaped units.
3. Provide continuity at corners by using prefabricated L-shaped units.
4. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.11 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Structural Anchors to Building Structure: Anchor masonry to structural members where masonry abuts or faces structural members to comply with following:

1. Unless otherwise indicated, provide an open space not less than 1/2 in (13 mm) in width between masonry and structural member. Keep open space free of mortar and other rigid materials.
2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 in (600 mm) on centers vertically and 36 in (900 mm) on centers horizontally.

4. Refer to Division 05 Section "Metal Fabrications" for requirements related to coordination between masonry and metal fabrications (Designation MF), including loose masonry lintel schedule, as shown on the Drawings.

3.12 ANCHORING MASONRY VENEERS

A. General: Refer to Division 04 Section "Masonry Veneer" for anchoring masonry veneer requirements.

3.13 CONTROL JOINTS

A. General: Install control joint materials as masonry progresses. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement. Maintain joints free and clear of mortar.

B. Control Joints: Form in concrete masonry using one of following methods:

1. Install preformed control-joint gaskets designed to fit standard sash block.
2. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
3. At structural bond beams, provide dummy groove or raked joint. Do not extend control joints through bond beams.

C. Control Joint Spacing: Locate control joints as indicated on the Drawings not to exceed 25 ft (7.5 m) on center. Keep control joints straight, true, and continuous from top to bottom of masonry. Form open control joint of width indicated for installation of sealant and backer rod specified in Division 07 Section “Joint Sealants”.

D. Horizontal Joints: Build in horizontal pressure-relieving joints as indicated; construct of width required for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants".

3.14 LINTELS

A. Steel Angle Lintels: Install where indicated and as scheduled on the Drawings.

B. Concrete or Masonry Lintels: Provide lintels where shown and where openings of more than 24 in (600 mm) for block-size units are shown without structural steel or other supporting lintels.

1. Provide precast concrete lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars required to support loads indicated.
2. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed and filled with coarse grout. Cure precast lintels before handling and installing.

C. Minimum Bearing: Provide 8 in (200 mm) at each jamb, unless otherwise indicated.

3.15 LOAD-BEARING MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 402/602.

1. Provide minimum bar lap splice not less than 48 bar diameters unless otherwise indicated.
2. Provide corner bars of same size and spacing as horizontal bars unless otherwise indicated.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 402/602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
3. Limit height of vertical grout pours to not more than 60 in (1500 mm).
4. Fill with grout, vertical cells, bond beams, lintels and other structural members having reinforcement. Secure in place and inspect reinforcing before grouting. Keep mortar droppings out of grout space and puddle or vibrate grout in place.
5. Provide solid bearing under structural members at least 8 in (200 mm) vertically and at least 16 in (400 mm) horizontally. Bearing may be solid units, or hollow units with grout. Fill cells in units adjacent to openings.
6. Grout from inside face of masonry and prevent grout from staining masonry face. Protect projecting surfaces from droppings and clean immediately any grout which comes in contact with face of masonry.

3.16 TOLERANCES

A. Conspicuous Lines:

1. Vertical: For such conditions as external corners, door and window jambs, reveals, and expansion joints, maximum variation of one of following from plumb:

a. 1/8 in (3 mm) per 10 ft (3 m).
b. 1/4 in (6 mm) per 20 ft (6 m).
c. 1/2 in (12 mm) overall.

2. Horizontal: For such conditions as exposed lintels, sills, door and window heads, parapets, and reveals, maximum variation of one of following from level:

a. 1/8 in (3 mm) per 10 ft (3 m).
b. 1/4 in (6 mm) per 20 ft (6 m).
c. 1/2 in (12 mm) overall.

B. Exposed Head Joints:

1. Vertical Alignment: Maximum variation of one of following from plumb:

a. 1/4 in (6 mm) per 10 ft (3 m).
b. 1/2 in (12 mm) from plumb top to bottom of wall.

2. Thickness: Maximum variation from width indicated of plus or minus 1/8 in (3 mm); maximum variation from adjacent bed joint and head joint thicknesses 1/8 in (3 mm).

C. Exposed Bed Joints: Maximum variation from width indicated of plus or minus 1/8 in (3 mm), with a maximum thickness limited to 1/2 in (12 mm); maximum variation from bed joint thickness of adjacent courses of 1/8 in (3 mm).

D. Flush Alignment: Maximum variation of 1/16 in (1.5 mm) except due to warpage of masonry units with tolerances specified for warpage of units.

E. Stack Bond: For exposed head joints and bed joints, maximum variation from a straight line of 1/16 in (1.5 mm) from one masonry unit to next.

3.17 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections and prepare reports:

1. Special inspections in accordance with TMS 402/602 and the Building Code.
2. Testing agency will report test results promptly and in writing to Contractor and Architect.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.18 ADJUSTING

A. Damaged Units: Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids and holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

3.19 PROTECTION

A. Protection of Work: When installed at building interiors, provide protection of lower 96 in (2400 mm) portion of decorative-faced concrete masonry in form of rigid panels to prevent damage and to resist staining.

B. Cleaning: During cleaning operations, protect surrounding areas, landscaping, adjacent surfaces, and vehicles from contact with cleaning products.

1. Clean surfaces prior to installation of windows and doors.
2. Avoid drifting of spray caused by wind.

3.20 CLEANING

A. In-Progress Cleaning: Clean unit masonry as Work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Protection: Prior to Final Cleaning, protect surrounding areas, landscaping, adjacent surfaces, and vehicles from contact with cleaning products.

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's acceptance of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.21 SCHEDULE

A. Basis of Design: CMU01

1. Manufacturer:
2. Product Series:
3. Color Name and Number:
4. Face Texture:
5. Bond Pattern: One-Half Running Bond.
6. Size (Actual Dimensions)

   a. Width: 7-5/8 in (190 mm).
   b. Height: 7-5/8 in (190 mm).
   c. Length: 15-5/8 in (390 mm).

B. Acoustical Concrete Masonry Units - Basis of Design: CMUXX

1. Manufacturer: The Proudfoot Company
2. Product Series: Soundblox Type RSC; acoustical concrete masonry unit with two slot type apertures with factory-installed noise attenuating fibrous fillers with laminated metal septum.
3. Color Name and Number:
4. Face Texture: Smooth.
5. Bond Pattern: One-Half Running Bond.
6. Size (Actual Dimensions)

   a. Width: 7-5/8 in (190 mm).
   b. Height: 7-5/8 in (190 mm).
   c. Length: 15-5/8 in (390 mm).

C. Mortar Color - Basis of Design: Use with CMUXX.

1. Manufacturer:
2. Product Series:
3. Color Name and Number:

END OF SECTION

SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural-steel materials.
2. Shrinkage-resistant grout.
3. Prefabricated building columns.
4. Shear stud connectors.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
3. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
4. [**Section 099113 "Exterior Painting" and Section 099123 "Interior Painting"**] [**and**] [**Section 099600 "High-Performance Coatings"**] for painting requirements.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "LFRS" on Drawings, including columns, beams, and braces and their connections.

C. Protected Zone: Structural members or portions of structural members indicated as "protected zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

D. Demand-Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the seismic-load-resisting system and which are indicated as "demand critical" or "seismic critical" on Drawings.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Forged-steel hardware.
7. Shop primer.
8. Galvanized-steel primer.
9. Galvanized repair paint.
10. Shrinkage-resistant grout.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for EPDs and HPDs.>
3. <Double click here to insert sustainable design text for Health Product Declaration.>
4. <Double click here to insert sustainable design text for sourcing of raw materials.>

C. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand-critical welds.
8. Identify members not to be shop primed.

D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

E. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, shop-painting applicators, professional engineer, testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural-steel materials, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.

F. Source quality-control reports.

G. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, [**Category ACSE**] [**Category CSE**].

C. Shop-Painting Applicator Qualifications: Qualified in accordance with AISC's Sophisticated Paint [**Endorsement P1**] [**Endorsement P2**] [**Endorsement P3**] or to SSPC-QP 3.

D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1. Welders and welding operators performing work on bottom-flange, demand-critical welds are to pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G are to be considered separate processes for welding personnel qualification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 341.
3. ANSI/AISC 360.

4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Option 1: Connection designs have been completed and connections indicated on the Drawings.
2. Option 2: Fabricator's experienced steel detailer selects or completes connections in accordance with ANSI/AISC 303.

   a. Select and complete connections using [**schematic details indicated**] [**and**] [**ANSI/AISC 360**] <**Insert source**>.
   b. Use [**Load and Resistance Factor Design; data are given at factored-load level**] [**Allowable Stress Design; data are given at service-load level**].

3. Option 3 and 3A: Design connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer. Member reinforcement at connections is indicated on Drawings.

   a. Use [**Load and Resistance Factor Design; data are given at factored-load level**] [**Allowable Stress Design; data are given at service-load level**].

4. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

   a. Use [**Load and Resistance Factor Design; data are given at factored-load level**] [**Allowable Stress Design; data are given at service-load level**].

C. Construction: Buckling restrained braced frames.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: **ASTM A992/A992M**

B. Channels, Angles: **ASTM A36/A36M**.

C. Plate and Bar: **ASTM A36/A36M**, or as noted.

D. Cold-Formed Hollow Structural Sections: **ASTM A500/A500M, Grade C** structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with plain finish.

B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490 (Grade A490M), Type 1, heavy-hex steel structural bolts[**or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends**]; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1 (Type 10.9-1), compressible-washer type with plain finish.

C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: [**Hot-dip zinc coating**] [**Mechanically deposited zinc coating**] [**Hot-dip or mechanically deposited zinc coating**].
2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with [**mechanically deposited zinc coating**] [**mechanically deposited zinc coating, baked epoxy-coated**] finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, [**heavy-hex**] [**round**] head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: [**Plain**] [**Mechanically deposited zinc coating**].

E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

A. Unheaded Anchor Rods: [**ASTM F1554, Grade 36**] [**ASTM F1554, Grade 55, weldable**] [**ASTM A354**] [**ASTM A449**] [**ASTM A572/A572M, Grade 50 (Grade 345)**] [**ASTM A36/A36M**].

1. Configuration: [**Straight**] [**Hooked**].
2. Nuts: ASTM A563 (ASTM A563M) [**heavy-**]hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
5. Finish: [**Plain**] [**Hot-dip zinc coating, ASTM A153/A153M, Class C**] [**Mechanically deposited zinc coating, ASTM B695, Class 50**].

B. Headed Anchor Rods: [**ASTM F1554, Grade 36**] [**ASTM F1554, Grade 55, weldable**] [**ASTM A354**] [**ASTM A449**], straight.

1. Nuts: ASTM A563 (ASTM A563M) [**heavy-**]hex carbon steel.
2. Plate Washers: ASTM A36/A36M carbon steel.
3. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
4. Finish: [**Plain**] [**Hot-dip zinc coating, ASTM A153/A153M, Class C**] [**Mechanically deposited zinc coating, ASTM B695, Class 50**].

C. Threaded Rods: [**ASTM A36/A36M**] [**ASTM A193/A193M, Grade B7**] [**ASTM A354, Grade BD**] [**ASTM A449**] [**ASTM A572/A572M, Grade 50 (Grade 345)**].

1. Nuts: ASTM A63 (ASTM A563M) [**heavy-**]hex carbon steel.
2. Washers: [**ASTM F436 (ASTM F436M), Type 1, hardened**] [**ASTM A36/A36M**] carbon steel.
3. Finish: [**Plain**] [**Hot-dip zinc coating, ASTM A153/A153M, Class C**] [**Mechanically deposited zinc coating, ASTM B695, Class 50**].

2.5 PRIMER

A. Steel Primer:

Retain one of three subparagraphs below. Insert proprietary primers if required as part of special coating or painting system. Coordinate primer selection with surface preparation and topcoats, requirements for slip-critical joints, and limitations of sprayed fire-resistive materials. Insert color if required.

1. Comply with [**Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."**] [**Section 099600 "High-Performance Coatings."**] [**Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."**]

Primer in first subparagraph below requires SSPC-SP 6 (WAB)/NACE WAB-3 commercial blast-cleaning surface preparation or better and 24 hours' drying before recoating. SSPC recommends two primer coats before exposing steel to exterior, and one or two topcoats.

2. SSPC-Paint 23, latex primer.

Fabricator's standard primer below requires SSPC-SP 2 surface preparation or better and usually provides minimal protection.

3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

Retain "Galvanized-Steel Primer" Paragraph below for painted, hot-dip galvanized structural steel.

B. Galvanized-Steel Primer: [**MPI#26**] [**MPI#80,**] [**MPI#134**].

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: [**MPI#18, MPI#19, or SSPC-Paint 20**] [**ASTM A780/A780M**].

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, [**mechanically thermal cut,**]or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with [**SSPC-SP 1.**] [**SSPC-SP 2.**] [**SSPC-SP 3.**]

F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.
   1. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   2. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

   1. Joint Type: As indicated.

B. Weld Connections: Comply with AWS D1.1/D1.1M[**and AWS D1.8/D1.8M**] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

   1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize [**lintels**] [**shelf angles**] [**and**] [**welded door frames**] attached to structural-steel frame and located in exterior walls.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.
   3. Surfaces of high-strength bolted, slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces [**unless indicated to be painted**].
   6. Corrosion-resisting (weathering) steel surfaces.
   7. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 7 (WAB)/NACE WAB-4.
4. SSPC-SP 14 (WAB)/NACE WAB-8.
5. SSPC-SP 11.
6. SSPC-SP 6 (WAB)/NACE WAB-3.
7. SSPC-SP 10 (WAB)/NACE WAB-2.
8. SSPC-SP 5 (WAB)/NACE WAB-1.
9. SSPC-SP 8.

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: [**Owner will engage**] [**Engage**] a qualified testing agency to perform shop tests and inspections.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect[**and test**] shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

   a. Liquid Penetrant Inspection: ASTM E165/E165M.
   b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
   c. Ultrasonic Inspection: ASTM E164.
   d. Radiographic Inspection: ASTM E94/E94M.

4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:

a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.

5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. [**Snug-tighten**] [**Pretension**] anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.[**Comply with manufacturer's written installation instructions for grouting.**]

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: As indicated.

B. Weld Connections: Comply with AWS D1.1/D1.1M **and AWS D1.8/D1.8M** for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs[**where indicated**], back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

C. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.5 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

    a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Cleaning and touchup painting are specified in [**Section 099113 "Exterior Painting."**] [**Section 099123 "Interior Painting."**] [**Section 099600 "High-Performance Coatings."**]

C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: [**Owner will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

    a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

        1) Liquid Penetrant Inspection: ASTM E165/E165M.
        2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
        3) Ultrasonic Inspection: ASTM E164.
        4) Radiographic Inspection: ASTM E94/E94M.

3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
b. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

END OF SECTION 051200

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 051213
ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Architecturally exposed structural-steel (AESS) framing and supplementary items required for installation.

1. Section 051200 "Structural Steel Framing" requirements that also apply to AESS.

1.2 DEFINITIONS

A. AESS: Architecturally exposed structural steel.

B. Category AESS 1: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 1 and may be designated AESS 1 or Category AESS 1 in the Contract Documents.

C. Category AESS 2: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 2 and is designated as AESS 2 or Category AESS 2 in the Contract Documents.

D. Category AESS 3: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 3 and is designated as AESS 3 or Category AESS 3in the Contract Documents.

E. Category AESS 4: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 4 and is designated as AESS 4 or Category AESS 4 in the Contract Documents.

F. Category AESS C: Structural steel with custom characteristics that is categorized by ANSI/AISC 303, Section 10, as AESS C and is designated as AESS C or Category AESS C in the Contract Documents.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS.

1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
3. Include embedment Drawings.
4. Indicate orientation of mill marks and HSS seams.
5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
7. Indicate exposed surfaces and edges and surface preparation being used.
8. Indicate special tolerances and erection requirements.
9. Indicate weep holes for HSS and vent holes for galvanized HSS.
10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.

B. Samples: Submit Samples to set quality standards for AESS.

1. Two steel plates, 3/8 by 8 by 4 inches (9.5 by 200 by 100 mm), with long edges joined by a groove weld and with weld ground smooth.
2. Steel plate, 3/8 by 8 by 8 inches (9.5 by 200 by 200 mm), with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches (100 by 150 by 9.5 mm), welded to plate with a continuous fillet weld and with weld ground smooth and blended.
3. Round steel tube or pipe, minimum 8 inches (200 mm) in diameter, with end of another round steel tube or pipe, approximately 4 inches (100 mm) in diameter, welded to its side at a 45-degree angle with a continuous fillet weld and with weld ground smooth and blended.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172) and is experienced in fabricating AESS similar to that indicated on this Project.

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program, is designated an AISC-Certified Erector, Category ACSE or Category CSE, and is experienced in erecting AESS similar to that indicated on this Project.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, Endorsement P2 or Endorsement P3.

D. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.

1. Build mockup of typical portion of AESS as shown on Drawings.
2. Coordinate painting requirements with Division 9 Section Painting.
3. Coordinate high-performance coatings requirements with Division 9 Section High Performance Coatings.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.

c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.

1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate surface preparation requirements for shop-primed items.

C. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Bolts, Connectors, and Anchors: Refer to Division 05 Section Structural Steel Framing.

2.2 PRIMER

A. Steel Primer for Painting: Refer to Division 09 Section Painting.

B. Steel Primer for High Performance Coatings: Refer to Division 09 Section High Performance Coatings.

2.3 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.

B. Category AESS 1:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates.
6. Limit butt and plug weld projections to 1/16 inch (1.6 mm).
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.

C. Category AESS 2:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates.
6. Limit butt and plug weld projections to 1/16 inch (1.6 mm).
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.

D. Category AESS 3:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.

2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates.
6. Limit butt and plug weld projections to 1/16 inch (1.6 mm).
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.
17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
19. Orient HSS seams as indicated or away from view.
20. Align and match abutting member cross sections.
21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch (3.2 mm). At closed joints, maintain uniform contact within 1/16 inch (1.6 mm).
22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.

E. Category AESS 4:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates.
6. Limit butt and plug weld projections to 1/16 inch (1.6 mm).
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.

12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.
17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
19. Orient HSS seams as indicated or away from view.
20. Align and match abutting member cross sections.
21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch (3.2 mm). At closed joints, maintain uniform contact within 1/16 inch (1.6 mm).
22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.
23. Treat HSS seams to appear seamless.
24. Contour and blend welds and weld transitions between members, removing splatter exposed to view.
25. Fill surface imperfections with filler and sand smooth to achieve surface quality approved by Architect.
26. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.

F. Category AESS C:

1. Customized list of applicable items.

G. Cleaning Corrosion-Resisting (Weathering) AESS: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6 (WAB)/NACE WAB-3.

2.4 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, Pretensioned, or Slip critical as indicated on Drawings or as specified in Division 05 Section "Structural Steel Framing".

B. Weld Connections - AISC 360 High Seismic Applications: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.5 GALVANIZING

A. Galvanizing: Refer to Division 05 Section Structural Steel Framing.

2.6 SHOP PRIMING

A. Painting: Refer to Division 09 Section Painting.

B. High Performance Coatings: Refer to Division 09 Section High Performance Coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.

C. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.
2. Where applicable, do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.

1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
2. Grind tack welds smooth.
3. Remove backing and runoff tabs, and grind welds smooth.
4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
5. Remove erection bolts in Category AESS 4 AESS, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
6. Fill weld access holes in Category AESS 4 AESS with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
7. Conceal fabrication and erection markings from view in the completed structure.

B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.

1. Erection of Category AESS 1 and Category AESS 2:

a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.

b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
c. Remove weld spatter, slivers, and similar surface discontinuities.
d. Grind off butt and plug weld projections larger than 1/16 inch (1.6 mm).
e. Continuous welds shall be of uniform size and profile.
f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
g. Splice members only where indicated on Drawings.
h. No torch cutting or field fabrication is permitted.

2. Erection of Category AESS 3:

a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
c. Remove weld spatter, slivers, and similar surface discontinuities.
d. Grind off butt and plug weld projections larger than 1/16 inch (1.6 mm).
e. Continuous welds shall be of uniform size and profile.
f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
g. Splice members only where indicated on Drawings.
h. No torch cutting or field fabrication is permitted.
i. Weld profiles, quality, and finish shall be as approved by Architect.
j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.

3. Erection of Category AESS 4:

a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
c. Remove weld spatter, slivers, and similar surface discontinuities.
d. Grind off butt and plug weld projections larger than 1/16 inch (1.6 mm).
e. Continuous welds shall be of uniform size and profile.
f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
g. Splice members only where indicated on Drawings.
h. No torch cutting or field fabrication is permitted.
i. Weld profiles, quality, and finish shall be as approved by Architect.
j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.
k. Grind welds smooth.
l. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
m. Oversize welds where ground, contoured, or blended, and grind to provide a smooth transition, matching profile approved by Architect.

C. Erection of Category AESS C:

1. Customized list of applicable items.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, pretensioned, or slip critical as indicated on Drawings or as specified in Division 05 Section "Structural Steel Framing".
2. Orient bolt heads as indicated on Drawings or, if not indicated, in same direction for each connection and to maximum extent possible in same direction for similar connections.

B. Weld Connections - AISC 360 High Seismic Applications: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

3.5 FIELD QUALITY CONTROL

A. Owner Testing Agency: Owner will engage a qualified testing agency to inspect AESS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.

B. Architect Observations: Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 PROTECTION

A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and touchup galvanizing to comply with ASTM A780/A780M.

C. Touchup Painting: Refer to Division 9 Section Painting for cleaning and touchup priming.

1. Unless indicated otherwise, immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting, to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

D. Touchup High Performance Coatings: Refer to Division 9 Section High Performance Coatings for cleaning and touchup priming.

END OF SECTION

SECTION 051250 - BUCKLING RESTRAINED BRACES AND CONNECTIONS (BRBS)

GENERAL

1.01 REFERENCE STANDARDS

AISC 341 - SEISMIC PROVISIONS FOR STRUCTURAL STEEL BUILDINGS; 2022.

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. AISC - American Institute of Steel Construction
   1. American Institute of Steel Construction's "Manual of Steel Construction", Fifteenth Edition (AISC)
      a. "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings", (((AISC 360))).
      b. "Code of Standard Practice for Steel Buildings and Bridges", (((AISC 303))).
      c. "Specification for Structural Joints Using ASTM A325 or A490 Bolts",
   2. American Institute of Steel Construction: "Seismic Provisions for Structural Steel Buildings", (((AISC 341))).

C. ASTM - American Society for Testing and Materials
   1. A6 - Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use.
   2. A36 - Specification for Steel Core Plate Material.
   3. ASTM A500, Gr. B or A53, Gr. B or similar for round sections A325 – Specification for Structural Steel Bolts.
   4. A490 – Specification for Heat-Treated Steel Structural Bolts, 150 ksi min. tensile strength.

D. AWS - American Welding Society
   1. "Structural Welding Code – Steel", (AWS D1.1).
   2. "Structural Welding Code – Seismic Supplement", (AWS D1.8).

E. Steel Structures Painting Council (SSPC):
   1. Steel Structures Painting Manual, latest edition.

PRODUCTS

3.01 DESIGN AND PERFORMANCE REQUIREMENTS

A. Delegated Design.

B. Performance Criteria:
   1. Initial "BRB" yield force or area shall be as indicated, within the tolerances specified on the Contract Documents.
   2. Stable cyclic displacement within the ranges required per AISC 341 up to a displacement corresponding to 2.0 x Design Story Drift.

C. Coupon tests.

D. Qualification tests.

3.02 ACCEPTABLE MANUFACTURERS

1. CoreBrace; West Jordan , UT (801) 280-0701, engineering@CoreBrace.Com
2. Nippon Steel; Tokyo, Japan, info@unbondedbrace.com
3. Approved equal.

3.03 MATERIALS

A. Steel Core Areas: JIS G 3136 SN400 B or ASTM A36.

B. Casing: JIS G3466 STKR 400, ASTM A500, Grade B, or ASTM A53 Gr. B.

C. Welding Filler Material: Meet or exceed CVN toughness and elongation of material used for fabrication of tested assemblies.

D. Primer –Standard shop primer

E. Debonding Agent: Manufacturer’s standard.

F. Fill Material: Manufacturer’s standard cementitious grout.

3.04 FABRICATION

A. Fabricate steel in accordance with Section 051200, "Structural Steel Framing."

1. Cut core plates to profile shown on Design Drawings. Conform to tolerances of Quality Assurance Manual, except tolerance on plate width shall not exceed plus or minus 0.2 inches (5 mm).
2. Splices in the steel core are not acceptable.
3. Roughness: After cutting, edges of core plates shall have roughness less than 1000 micro-inches.
4. Gouges and Notches: Occasional gouges and notches in the yielding length less than 0.2 inches (5 mm) deep in edges of core plates may be repaired by grinding to a smooth transition. The length of transition shall be a minimum of 10 times the depth of gouge. The area shall be inspected by MT after grinding to ensure the entire depth of gouge has been removed. Notches in the yielding length region greater than 0.375 inches (9.5mm) in the yield length shall be rejected.

B. The maximum dimensions of the casing of the buckling restrained brace shall be as indicated on the Contract Documents.

C. Bolted Connections: All holes for bolted connections shall be drilled and burrs removed.

D. Pin Connections: All holes for pinned connections shall be machined 1/32 in larger than the pin diameter. Pin hole tolerance shall not exceed plus or minus 1/64 in.

E. Welding: Weld joints using procedures intended to minimize distortion.

1. Where cruciform plates are terminated in core, pay particular attention to the detailing and finishing of weld termination; meet or exceed qualification tested assembly as minimum standard.

F. Assembly: Assemble components of the Buckling Restrained Brace in a manner to ensure proper performance of the brace.
   1. Examine steel core areas for straightness prior to coating with debonding agent or pouring with concrete.
   2. Provide end-confining plates to ensure confinement of the fill material while allowing for non-restricting movement of the steel core.
   3. For braces exposed to exterior or corrosive conditions, interior of brace shall be sealed or otherwise protected from moisture/corrosive element infiltration into the interior core region.

G. Finish shall be manufacturer’s standard shop primer. Do not paint connection faying surfaces if connection are designated slip critical unless paint used provides same slip resistance

3.05 SOURCE QUALITY CONTROL

A. Testing Laboratory will:
   1. Review Manufacturer’s Quality Assurance Plan, mill certificates and results of coupon testing.
   2. Review Manufacturer's quality assurance test and inspection reports.
   3. Observe fabrication and assembly as requested by Owner's Representative.

B. Contractor shall:
   1. Notify Owner's Representative no less than 30 days before the start of fabrication of the buckling restrained braces, to allow Owner's Representative to observe fabrication and assembly process.
   2. Perform testing and inspection in accordance with approved Quality Assurance Plan and requirements of Contract Documents.

EXECUTION

4.01 ERECTION

A. Braces are erected under Section 051200, "Structural Steel Framing."

B. No field welding to buckling restrained brace members will be permitted, including attachment of nonstructural components.

END OF SECTION 051250

SECTION 053100

STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.
2. Composite floor deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for regional materials.>
3. <Double click here to insert sustainable design text for Health Product Declaration.>
4. <Double click here to insert sustainable design text for sourcing of raw materials.>

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

a. Power-actuated mechanical fasteners.

2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

E. Qualification Statements: For [**welding personnel**] [**and**] [**testing agency**].

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:

1. AWS D1.1/D1.1M.
2. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

2.2 ROOF DECK

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), [**Grade 33 (230)**] [**Grade 40 (275)**] [**Grade 80 (550)**] minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

   a. Color: [**Manufacturer's standard**] [**Gray**] [**White**] [**Gray top surface with white underside**].

2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), [**Grade 33 (230)**] [**Grade 40 (275)**] [**Grade 80 (550)**], [**G60 (Z180)**] [**G90 (Z275)**] zinc coating.
3. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), [**Grade 33 (230)**] [**Grade 40 (275)**] [**Grade 80 (550)**], G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

   a. Color: [**Manufacturer's standard**] [**Gray**] [**White**] [**Gray top surface with white underside**].
4. Deck Profile: As indicated.
5. Profile Depth: As indicated.
6. Design Uncoated-Steel Thickness: As indicated.
7. Span Condition: As indicated.
8. Side Laps: Interlocking seam.

2.3 COMPOSITE FLOOR DECK

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Fabrication of Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI C, with the minimum section properties indicated, and with the following:

1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), [**Grade 33 (230)**] [**Grade 40 (275)**] [**Grade 80 (550)**] minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard [**gray**] [**or**] [**white**] baked-on, rust-inhibitive primer.

2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), [**G30 (Z90)**] [**G60 (Z180)**] [**G90 (Z275)**] zinc coating.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: As indicated.

2.4 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile **indicated**.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, [**0.0598 inch (1.52 mm)**] [**0.0747 inch (1.90 mm)**] thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

J. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and [**level**] [**sloped**] recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

L. Galvanizing Repair Paint: [**ASTM A780/A780M**] [**SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight**].

M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

J. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 3/4 inch (19 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated, and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: **Lapped 2 inches (50 mm) minimum or butted at Contractor's option**.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. [**Weld**] [**or**] [**mechanically fasten**] to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.

3.4 INSTALLATION OF FLOOR DECK

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: **3/4 inch (19 mm)**, nominal.
2. Weld Spacing: As indicated

3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: **Lapped or butted at Contractor's option**.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on [**both surfaces**] [**top surface**] of prime-painted deck immediately after installation, and apply repair paint.
2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: [**Owner will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.

a. Field welds will be subject to inspection.

2. Steel decking will be considered defective if it does not pass tests and inspections.
3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:

    a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
    b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors that are already tested.

C. Prepare test and inspection reports.

END OF SECTION 053100

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing.
4. Floor joist framing.
5. Roof rafter framing.
6. Ceiling joist framing.
7. Soffit framing.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1. <**Insert participants**>.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing.
4. Vertical deflection clips.
5. Single deflection track.
6. Double deflection track.

7. Drift clips.
8. Ceiling joist framing.
9. Soffit framing.
10. Post-installed anchors.
11. Power-actuated anchors.
12. Sill sealer gasket.
13. Sill sealer gasket/termite barrier.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for EPDs and HPDs.>

C. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

D. Delegated Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency[**, or in-house testing with calibrated test equipment,**] indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of [**the Certified Steel Stud Association**] [**the Steel Framing Industry Association**] [**the Steel Stud Manufacturers Association**] [**or**] [**the Supreme Steel Framing System Association**].

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: **As indicated on Drawings**.
2. Deflection Limits: Design framing systems to withstand **design loads** without deflections greater than the following:
   a. of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
   b. Exterior Non-Load-Bearing Framing: Horizontal deflection of **1/600** of the wall height.
   c. Interior Non-Load-Bearing Framing: Horizontal deflection of **1/240** of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
   d. Ceiling Joist Framing: Vertical deflection of **1/240** of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

   a. Upward and downward movement of [**1/2 inch (13 mm)**] [**3/4 inch (19 mm)**] [**1 inch (25 mm)**] [**1-1/2 inches (38 mm)**].

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and [**ASTM C955**] [**AISI S200 and ASTM C955, Section 8**] [**AISI S240**].

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. <Double click to insert sustainable design text for recycled content.>

B. Framing Members, General: Comply with [**ASTM C955**] [**AISI S200 and ASTM C955, Section 8**] [**AISI S240**] for conditions indicated.

C. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

   1. Grade: [**ST33H (ST230H)**] [**ST50H (ST340H)**] [**As required by structural performance**] <**Insert grade**>.
   2. Coating: [**G60 (Z180)**, **A60 (ZF180)**, **AZ50 (AZM150)**, **or GF30 (ZGF90)**] [**G90 (Z275) or equivalent**] <**Insert coating designation**>.

D. Steel Sheet for [**Vertical Deflection**] [**Drift**] Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

   1. Grade: [**33 (230)**] [**50 (340)**, **Class 1**] [**As required by structural performance**] <**Insert grade**>.
   2. Coating: [**G60 (Z180)**] [**G90 (Z275)**] <**Insert coating designation**>.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: [**0.0329 inch (0.84 mm)**] [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] <**Insert dimension**>.
2. Flange Width: [**1-3/8 inches (35 mm)**] [**1-5/8 inches (41 mm)**] [**2 inches (51 mm)**] [**2-1/2 inches (63 mm)**] <**Insert dimension**>.
3. Section Properties: <**Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment**>.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: [**0.0329 inch (0.84 mm)**] [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] [**Matching steel studs**] <**Insert dimension**>.
2. Flange Width: [**1-1/4 inches (32 mm)**] <**Insert dimension if manufacturer's standard width is insufficient**>.

C. Vertical Deflection Clips, Exterior: Manufacturer's standard [**bypass**] [**head**] clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] <**Insert dimension**>.
2. Flange Width: [**1 inch (25 mm) plus the design gap for one-story structures**] [**and**] [**1 inch (25 mm) plus twice the design gap for other applications**] <**Insert dimension**>.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: [**0.0329 inch (0.84 mm)**] [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] <**Insert dimension**>.
b. Flange Width: [**1 inch (25 mm) plus the design gap for one-story structures**] [**and**] [**1 inch (25 mm) plus twice the design gap for other applications**] <**Insert dimension**>.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] <**Insert dimension**>.
b. Flange Width: <**Insert dimension equal to sum of outer deflection track flange width plus 1 inch (25 mm)**>.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: [**0.0329 inch (0.84 mm)**] [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] <**Insert dimension**>.
2. Flange Width: [**1-3/8 inches (35 mm)**] [**1-5/8 inches (41 mm)**] [**2 inches (51 mm)**] [**2-1/2 inches (63 mm)**] <**Insert dimension**>.
3. Section Properties: <**Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment**>.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: [**0.0329 inch (0.84 mm)**] [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] [**Matching steel studs**] <**Insert dimension**>.
2. Flange Width: [**1-1/4 inches (32 mm)**] <**Insert dimension if manufacturer's standard width is insufficient**>.

C. Vertical Deflection Clips, Interior: Manufacturer's standard [**bypass**] [**head**] clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] <**Insert dimension**>.
2. Flange Width: [**1 inch (25 mm) plus the design gap for one-story structures**] [**and**] [**1 inch (25 mm) plus twice the design gap for other applications**] <**Insert dimension**>.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

   a. Minimum Base-Metal Thickness: [**0.0329 inch (0.84 mm)**] [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] <**Insert dimension**>.
   b. Flange Width: [**1 inch (25 mm) plus the design gap for one-story structures**] [**and**] [**1 inch (25 mm) plus twice the design gap for other applications**] <**Insert dimension**>.

2. Inner Track: Of web depth indicated, and as follows:

   a. Minimum Base-Metal Thickness: [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] <**Insert dimension**>.
   b. Flange Width: <**Insert dimension equal to sum of outer deflection track flange width plus 1 inch (25 mm)**>.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, [**unpunched,**] [**punched with standard holes,**] [**punched with enlarged service holes,**] with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: [**0.0329 inch (0.84 mm)**] [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] <**Insert dimension**>.

2. Flange Width: [**1-5/8 inches (41 mm)**] [**2 inches (51 mm)**] [**2-1/2 inches (63 mm)**] <**Insert dimension**>, minimum.
3. Section Properties: <**Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment**>.

2.7 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: [**0.0329 inch (0.84 mm)**] [**0.0428 inch (1.09 mm)**] [**0.0538 inch (1.37 mm)**] [**0.0677 inch (1.72 mm)**] [**0.0966 inch (2.45 mm)**] <**Insert dimension**>.
2. Flange Width: [**1-5/8 inches (41 mm)**] [**2 inches (51 mm)**] [**2-1/2 inches (63 mm)**] <**Insert dimension**>, minimum.
3. Section Properties: <**Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment**>.

2.8 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.9 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, [**Grade 36**] [**Grade 55**], threaded carbon-steel [**hex-headed bolts,**] [**headless, hooked bolts,**] [**headless bolts, with encased end threaded,**] carbon-steel nuts, and flat, hardened-steel washers; zinc coated by [**hot-dip process according to ASTM A153/A153M, Class C**] [**mechanically deposition according to ASTM B695, Class 50**].

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on [**ICC-ES AC01**] [**ICC-ES AC193**] [**ICC-ES AC58**] [**or**] [**ICC-ES AC308**] as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: [**Torque-controlled expansion anchor**] [**Torque-controlled adhesive anchor**] [**or**] [**adhesive anchor**].
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy [**Group 1 (A1)**] [**Group 2 (A4)**] stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.10 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: [**ASTM A780/A780M**] [**MIL-P-21035B**] [**or**] [**SSPC-Paint 20**].

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

F. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil (1.7-mm) nominal thickness, self-adhering sheet consisting of 64 mils (1.6 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side[**; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction**].

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Physical Properties:

   a. Peel Adhesion: 17.0 lb/in of width (2.9 N/mm of width) when tested in accordance with ASTM D412.
   b. Low-Temperature Flexibility: Pass at minus 25 deg F (minus 32 deg C) when tested in accordance with ASTM D146/D146M.
   c. Water Vapor Permeance: 0.05 perm (0.44 ng/Pa x s x sq. m) maximum when tested in accordance with ASTM E96/E96M, Method B.
   d. Resistance to Termite Penetration: Comply with ICC-ES AC380.

2.11 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to[**top and**] bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**19.2 inches (488 mm)**] [**24 inches (610 mm)**] [**As indicated on Drawings**] <**Insert dimension**>.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to [**bypassing**] [**infill**] studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated[**on Shop Drawings**] but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within [**12 inches (305 mm)**] [**18 inches (450 mm)**] of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at [**96-inch (2440-mm) centers**] [**centers indicated**] [**centers indicated on Shop Drawings**].

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to[**top and**] bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**19.2 inches (488 mm)**] [**24 inches (610 mm)**] [**As indicated on Drawings**] <**Insert dimension**>.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated[**on Shop Drawings**] but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within [**12 inches (305 mm)**] [**18 inches (450 mm)**] of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at [**96-inch (2440-mm) centers**] [**centers indicated**] [**centers indicated on Shop Drawings**].

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 054300
SLOTTED CHANNEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Slotted channel framing and accessories necessary to complete installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include the following:

1. Strapping, bracing, bridging, splices, and connection details.

2. Materials, sizes, spacings, and thicknesses.
3. Specifics for equipment being supported by framing.
4. Adjacent building structure, mechanical and electrical elements.
5. Details for anchoring and attachment to building structure.

1.4 INFORMATIONAL SUBMITTALS

A. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation..

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Horizontal Spanning Members; Upper, Lower and Main Subrails:

a. Cooper B-Line, Inc.; B12A channels
b. Hilti; MQ-124X channels
c. Unistrut Corp.; P5501 channels

2. Vertical Columns:

a. Cooper B-Line, Inc.; BTS 22TH struts

b. Hilti; MQ-41 channels
c. Unistrut Corp.; P9200 tubes

3. Diagonal and Horizontal Bracing:

a. Cooper B-Line, Inc.; BTS 22 channels
b. Hilti; MQ-41 channels
c. Unistrut Corp.; P1000 channels

4. Inside Vertical Columns:

a. Cooper B-Line, Inc.; BTS 22TH struts
b. Hilti; MQ-41 channels
c. Unistrut Corp.; P1000 H3 channels

2.2 SYSTEM DESCRIPTION

A. Equipment Support: Framing consisting of necessary slotted channel framing members such as beams, columns, braces, fittings, spanning members, longitudinal rails, track supports, and components such as channel connectors, nuts, bolts, washers, shim plates, and general hardware, for a complete and properly functioning support structure for equipment.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Engineering Quality Standards: Determine allowable working stresses of materials according to authorities having jurisdiction, applicable local building codes, framing manufacturers design data, MFMA-4, and MFMA-103.

C. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Design Loads: As required by scheduled equipment.
2. Design Criteria:

a. Equipment Information: Coordinate engineering with information provided by manufacturer of equipment being supported.
b. Minimum Factor of Safety: 2 based on ultimate strength under static loading conditions.

D. Deflection of Framing Members:

1. Limited to L/720 of span in either plane (vertical or horizontal) when maximum loading conditions is applied on either rail, due to equipment operation, including positioning of equipment at extremities of its travel

E. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:

1. Live Load Deflection: Accommodate differential vertical deflection of floors:

a. Deflection: As indicated on Drawings.

F. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

2.4 FRAMING MATERIALS AND COMPONENTS

A. Slotted Channels:

1. Product Quality Standard: MFMA-4.
2. Interior Locations: C-shape channels fabricated from ASTM A 1011 Grade 33 cold-rolled steel sheet or ASTM A 1008 Grade 33 for hot-rolled steel sheet, structural classification; with continuous open slot formed by inturned serrated or unserrated lips, and intermediate slots in back of channel; riveted back-to-back type for primary horizontal framing members; wall thickness as required by engineering design.

   a. Painted Factory Finish: Chemically cleaned, phosphated, electro deposited acrylic or electrostatically-applied polyester finished, then baked; resisting minimum 300 hours of salt spray exposure according to ASTM B 117.

3. Exterior Locations: C-shape channels fabricated from ASTM A 653 Grade 33 steel sheet, structural classification, with G90 hot-dip galvanized finish; with continuous open slot formed by inturned serrated or unserrated lips and intermediate slots in back of channel; back-to-back type for primary horizontal framing members; wall thickness as required by engineering design.
4. Profile Size: 1-5/8 in (40 mm) wide by depth required by delegated engineering.

B. Channel Connectors: Standard 2 part connectors of type, size and material required by delegated engineering; fabricated from carbon steel with nuts and threaded bolts; with or without springs; electro-galvanized finish; from same manufacturer as slotted channels.

C. General Hardware: Standard fittings, bases, brackets, and clamps of three-dimensional shape suitable for condition and type, size and material required by delegated engineering; fabricated from carbon steel; same finish as slotted channels; from same manufacturer as slotted channels.

D. Fasteners to Building Structure: Welding rods and expansion anchors as specified in Division 5 Section “Metal Fabrications.”

E. PVC Closure Strip: Paintable PVC closure strip; Unistrut Corp; P1184P, grey color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. MFMA-103.
2. Respective manufacturer/fabricator’s written installation instructions.
3. Accepted submittals.
4. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Erection:

1. Install slotted channel framing members and components square, true to line, level and plumb; and securely in place to properly support schedule equipment.
2. Cut slotted channels with powered cutting saws; flame-cutting is not permitted.
3. Tighten all connections to torque required by engineering design

B. Tolerances:

1. Horizontal Mounting Surfaces: Align within 1/32 in (0.8 mm) in 24 in (600 mm) and within 1/16 in (1.5 mm) in 18 ft (5.4 m).
2. Elevation Between Rails: Difference between 2 rails within 1/16 in (1.5 mm) in 24 in (600 mm).

C. PVC Closure Strips: Install at all exposed rails.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 055000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal fabrications and supplementary items necessary for installation.

1. Miscellaneous Framing and Supports: For applications where framing and supports are not specified in other Sections.
2. Shelf angles.
3. Metal ladders.
4. Alternating tread devices.
5. Metal ships' ladders.
6. Elevator pit sump covers.
7. Miscellaneous steel trim.
8. Metal bollards.
9. Loose steel lintels
10. Pipe and downspout guards.
11. Abrasive metal treads and thresholds.
12. Abrasive metal nosings.

B. Related Requirements:

1. Division 4 Sections Masonry Veneer and Concrete Unit Masonry for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Division 5 Section Structural Steel Framing for steel framing, supports, elevator machine beams, hoist beams, divider beams, and other steel items attached to the structure.

1.2 DEFINITIONS

A. Unprotected Areas, Exterior Locations: Exterior areas exposed to the elements including but not limited to rain, snow, or ice.

B. Protected Areas, Interior and Exterior Protected Locations: Interior and protected exterior areas not exposed to the elements including but not limited to rain, snow, or ice.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer/fabricator’s technical literature for each product and system indicated.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: For each type and finish of extruded nosing.

1.4 INFORMATIONAL SUBMITTALS

A. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

B. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

C. Field Quality Control Reports: Written report of testing and inspection required by “Field Quality Control”.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

C. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

D. Coordinate engineered miscellaneous steel framing and supports as required to comply with performance requirements and to provide a complete installation of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

B. Repair or replace damaged materials or structures as directed

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers/fabricators offering products that may be incorporated into the Work include but are not limited to those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers/fabricators offering

products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Provide engineered miscellaneous steel framing and supports as required to comply with performance requirements and to provide a complete installation of the Work.

B. Structural Performance of Alternating Tread Devices: Alternating tread devices are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Comply with applicable railing loadings in Section 055213 "Pipe and Tube Railings."

C. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

2.4 METAL MATERIALS, GENERAL

A. Metals, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

1. Unprotected Areas, Exterior Locations and Where Indicated:

a. Hot-Dip Galvanized Steel Components. Provide hot dip galvanized steel components.

2. Protected Areas, Interior and Exterior Protected Locations:

a. Non-Galvanized Steel Components: Provide uncoated, non-galvanized carbon steel components, unless otherwise indicated.

3. Aluminum and Stainless-Steel Components: As scheduled or indicated on Drawings.

a. Stainless steel Type 304 or Type 316 for corrosive environments.

4. Marking Systems for Metal Fabrications: Where finished items are exposed to view, use temporary tags attached with wires or other system acceptable to Architect.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304 or Type 316L for corrosive environments.

D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304 or Type 316L for corrosive environments.

E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

G. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

H. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.

I. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.

J. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.5 METAL FLOOR PLATE MATERIALS

A. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

2.6 METAL DECKING MATERIALS

A. Metal Deck: 1-1/2 in (38 mm), ASTM A 653 / A 653M, Structural Steel (SS) G90 (Z275) hot-dip galvanized coating both sides; cleaned, pretreated and primed with manufacturer standard baked-on rust inhibitive prime, outside face only if indicated below.

1. Deck Profile: As indicated or Type B deck if not indicated.
2. Design Uncoated-Steel Thickness: 0.0358 in (20 gage) (.91 mm) or as indicated on drawings.
3. Side Laps: Overlapped.
4. Location: As indicated on Drawings.

a. Dumpster enclosure; prime outside face.
b. Underside of seating bowl.

B. Metal Deck – Roof Screenwalls: 3 in (76 mm), ASTM A 653 / A 653M, Structural Steel (SS) G90 (Z275) hot-dip galvanized coating both sides; cleaned, pretreated and primed with manufacturer standard baked-on rust inhibitive prime, outside face only.

1. Deck Profile: As indicated or Type N (Deep, Wide Rib) deck if not indicated.
2. Design Uncoated-Steel Thickness: 0.0598 in (16 gage) (1.52 mm) minimum.
3. Side Laps: Overlapped.
4. Location: As indicated on Drawings.

a. Roof mechanical equipment screen wall.

2.7 FASTENERS

A. General: Select fasteners for type, grade, and class required to comply with performance requirements and produce connections suitable for environmental exposure and anchoring metal fabrications to other construction indicated.

1. Unprotected Areas, Exterior Locations and Where Indicated:

a. Hot-Dip Galvanized Steel Components: Hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
b. Stainless steel Type 304 or Type 316 for corrosive environments.

2. Protected Areas, Interior and Exterior Protected Locations:

a. Non-Galvanized Steel Components: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated

3. Aluminum and Stainless-Steel Components: As scheduled or indicated on the Drawings.

a. Stainless steel Type 304 or Type 316 for corrosive environments.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ISO 898-1, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593 (ISO 3506-1); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1) Type 304 or Group 2 (A4) Type 316 for corrosive environments.

D. Steel Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Plain Washers: Round carbon steel, ASME B18.22.1/ASME B18.22M.

F. Lock Washers: Helical, spring type carbon steel, ASME B18.21.1/ASME B18.21.2M.

G. Eyebolts: ASTM A 489.

H. Machine Screws: ASME B18.6.3/B18.6.7M.

I. Lag Screws: ASME B18.2.1/B18.2.3.8M.

J. Wood Screws: ASME B18.6.1, flat head, carbon steel.

2.8 ANCHORS

A. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Unprotected Areas, Exterior Locations and Where Indicated:

a. Hot-Dip Galvanized Steel Components: Hot-dip zinc-coated steel bolts, ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
b. Stainless steel Type 304 or Type 316 for corrosive environments.

2. Protected Areas, Interior and Exterior Protected Locations:

a. Non-Galvanized Steel Components: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

3. Aluminum and Stainless-Steel Components: As scheduled or indicated on Drawings.

a. Stainless steel Type 304 or Type 316 for corrosive environments.

4. Post-Tensioned Concrete Locations: Anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer written approval for all proposed anchors in post-tensioned concrete prior to installation.

2.9 PAINT MATERIALS

A. Coordination: Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Shop Primers for Paint: Provide primers that comply with Division 09 Section Painting.

1. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.

C. Shop Primers for High Performance Coatings: Provide primers that comply with Division 09 Section High Performance Coatings.

1. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.10 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Nonmetallic, Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

C. Concrete: Comply with requirements in Division 3 Section Cast-in-Place Concrete for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.11 FABRICATION OF METAL, GENERAL

A. General: Fabricate metal fabrications, including clips, brackets, and other components necessary to support and anchor fabrications to supporting structure, and to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

1. Fabricate and join components by welding unless otherwise indicated.
2. Fabricate hot-dip galvanized fabrications utilizing bolted connections and not welding for field assembly.

B. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

1. Complete fabrication prior to shop painting or hot-dip galvanizing.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Shop-Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. Weld corners and seams continuously to develop full strength of member to comply with following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing[and contour of welded surface matches that of adjacent surface].

I. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

J. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

K. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.12 MISCELLANEOUS FRAMING AND SUPPORTS

A. Miscellaneous Framing and Supports, General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 in (32 mm) wide by 1/4 in (6 mm) thick by 8 in (200 mm) long at 24 in (600 mm) on center, unless otherwise indicated.

2.13 SHELF ANGLES

A. Shelf Angles: Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity-wall exterior wythe.

1. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

C. Galvanize shelf angles located in exterior walls.

1. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.14 METAL LADDERS

A. Metal Ladders, General: Comply with the following unless indicated otherwise.

1. Standard Fixed Ladders: ANSI/ASC A14.3.
2. Elevator Pit Ladders: ASME A17.1/CSA B44.

B. Ladder Configuration: As indicated on Drawings.

1. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout
2. Nonslip Coating: Proprietary, engineered to form a permanent, uniform, slip resistant surface texture on metals. Color as selected from manufacturer standard colors.

a. Wet Static Static Coefficient of Friction Characteristics: Not less than 0.68 according to ASTM F 1679.
b. Manufacturer/Fabricators:

1) IKG Industries, Division of Harsco Corporation.
2) SlipNOT Metal Safety Flooring, W. S. Molnar Company.

3. Manufacturerd Rung: Proprietary nonslip rungs surfaces on top of each rung by coating with abrasive material metallically bonded to rung.

a. Wet Static Static Coefficient of Friction Characteristics: Not less than 0.68 according to ASTM F 1679.
b. Manufacturers and Products:

1) Algrip; Slip-Resistant Ladder Rungs and Floor Plate.
2) McNichols; Traction Tread Ladder Rung Plank.
3) P&R Metals; SlipNOT Ladder Rungs

C. Ladder Fall Protection Safety System for Fixed Ladders 24 Feet or Higher: Ladder safety or personal fall arrest systems complying with OSHA requirements in 29 CFR 1910.29 and ASSP Z359.16.

1. Basis of Design: 3M | DBI Sala; Lad-Saf Flexible Cable Vertical Safety Systems, Rung 2 User Stainless Steel 6116, cable length as required by ladder configuration.

a. Type: Stainless-steel cable fall arrest system with cable tensioner, shock absorber and automatic runner bypass for continuous hands-free operation.
b. Data Plate: Permanent, non-corrosive plate clearly stating maximum service capacity and allowable number of users; prominently displayed at access points to system.
c. Harness: Manufacturer's standard Hands-free full body harness and lanyard complete with shock absorber

2.15 ALTERNATING TREAD DEVICES

A. Alternating Tread Devices: Fabricate alternating tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

1. Alternating Tread Device Configuration: As indicated on Drawings.

a. Manufacturers:

1) Lapeyre Stair Inc.
2) Schmidt Structural Products; a subsidiary of Penco Products, Inc.

2. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."

2.16 METAL SHIPS' LADDERS

A. Metal Ships' Ladders: Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

2.17 ELEVATOR PIT SUMP COVERS

A. Elevator Pit Sump Covers: As indicated on Drawings.

1. Fabricate from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1 inch (25 mm) in least dimension.
2. Provide steel angle supports unless otherwise indicated.

B. Galvanize grating.

2.18 MISCELLANEOUS STEEL TRIM

A. Miscellaneous Steel Trim: Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

1. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
2. Provide with integrally welded steel strap anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 in (150 mm) from each end, 6 in (150 mm) from corners, and 24 in (600 mm) on center, unless otherwise indicated.

2.19 METAL BOLLARDS

A. Metal Bollards – Non-Removable: Steel bollards with concrete footing or steel baseplates for bolting to concrete slab; configuration as indicated on Drawings.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

B. Metal Bollard Covers: High-density Polyethylene (HDPE), impact resistant thermoplastic polymer with UV inhibitors, 1/8-inch minimum thickness.

1. Basis of Design: Post Guard; Dome Top Bollard Cover, diameter and height as indicated.

C. Metal Bollards – Removable: Two-piece steel construction with flush-mount embedment sleeve, powder-coated yellow finish; configuration as indicated on Drawings.

1. Basis of Design: Post Guard; Removable Bollards.

D. Galvanize, prime and paint metal bollards unless indicated otherwise.

2.20 PIPE AND DOWNSPOUT GUARDS

A. Pipe and Downspout Guards: Fabricate pipe and downspout guards from steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch (50-mm) clearance between pipe and pipe guard. Drill each end for anchor bolts.

B. Galvanize, prime and paint steel guards.

2.21 ABRASIVE METAL TREADS, AND THRESHOLDS

A. Abrasive Metal Treads, and Thresholds, Cast-Metal Units: Cast metal with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Manufacturers:

a. ACL Industries, Inc.
b. American Safety Tread Co., Inc.
c. Amstep Products.
d. Armstrong Products, Inc.
e. Balco Inc.
f. Granite State Casting Co.
g. Wooster Products Inc.

2.22 ABRASIVE METAL NOSINGS FOR CAST IN PLACE CONCRETE STAIRS

A. Abrasive Metal Nosings, General: Cast metal with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Manufacturers:

a. ACL Industries, Inc.
b. American Safety Tread Co., Inc.
c. Amstep Products.
d. Armstrong Products, Inc.
e. Balco Inc.
f. Granite State Casting Co.
g. Wooster Products Inc.

2. Nosings for Metal Pan Stairs: Refer to Division 05 Section Metal Stairs.

B. Abrasive Metal Nosings:

1. Basis of Design: Wooster Products Inc.; Supergrit, WP-RN3SG; color as selected by Architect from manufacturer's full range of colors.
2. Material: Aluminum, extruded.
3. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.

C. Abrasive Metal Nosings for Exit Stairs at High Rise Buildings: Provide photoluminescent strips, minimum 1 in (25 mm) wide by full width of stair nosing, incorporated into abrasive surfaced nosings

1. Basis of Design: Wooster Products Inc.; Supergrit, WP-RN3SG; color as selected by Architect from manufacturer's full range of colors.
2. Material: Aluminum, extruded

3. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion

D. Apply clear lacquer to concealed surfaces of extruded units.

E. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

2.23 CAST-IRON WHEEL GUARDS

A. Cast-Iron Wheel Guards: Provide wheel guards of size and shape indicated.

B. Galvanize, prime and paint wheel guards.

2.24 LOOSE STEEL LINTELS

A. Loose Steel Lintels: Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Galvanize, prime and paint loose steel lintels located in exterior walls.

2.25 STEEL WELD PLATES AND ANGLES

A. Steel Weld Plates and Angles: Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.26 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.27 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. Shop Priming:

1. Shop Primer for Galvanized Steel: Apply shop primer formulated for exterior use over zinc-coated metal components.

a. Preparation: Comply with requirements of painting system, but not less than minimum requirements of SSPC-SP 16 surface preparation specifications

2. Shop Primer for Uncoated Surfaces: Apply shop primer to uncoated surfaces of metal components.

a. Preparation: Comply with requirements of painting system, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications

3. Application: Comply with SSPC-PA 1, Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel, for shop painting.

   a. Primer need not be applied to surfaces to be embedded in concrete or masonry.

C. Field-Applied Coatings: Paint all metal fabrications unless noted otherwise.

1. Painting: Comply with Division 09 Section Painting.
2. High Performance Coatings: Comply with Division 09 Section High Performance Coatings

2.28 STAINLESS STEEL FINISHES

A. Stainless Steel Fabrications: As-fabricated finish.

2.29 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive metal fabrications and associated Work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer/fabricator’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work

3.4 INSTALLATION OF METAL FABRICATIONS, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.5 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.6 INSTALLATION OF SHELF ANGLES

A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

B. Anchor shelf angles securely to existing construction.

3.7 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets as required to secure ladders welded or bolted to structural steel or built into masonry or concrete.

3.8 INSTALLATION OF ALTERNATING TREAD DEVICES

A. Secure top and bottom of alternating tread devices to construction to comply with manufacturer's written instructions.

3.9 INSTALLATION OF METAL SHIPS' LADDERS

A. Secure top and bottom of ships' ladders to construction to comply with manufacturer's written instructions.

3.10 INSTALLATION OF MISCELLANEOUS STEEL TRIM

A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.11 INSTALLATION OF METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

1. Do not fill removable bollards with concrete.

B. Anchor bollards to existing construction with expansion anchors or anchor bolts. Provide four bolts at each bollard unless otherwise indicated.

1. Embed anchor bolts at least 4 inches (100 mm) in concrete.

C. Anchor bollards in place with concrete footings. Center and align bollards. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

3.12 INSTALLATION OF PIPE AND DOWNSPOUT GUARDS

A. Provide pipe guards at exposed vertical pipes in parking garage and at locations indicated on Drawings where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch (19-mm) bolts at each pipe guard. Mount pipe guards with top edge 26 inches (660 mm) above driving surface.

3.13 INSTALLATION OF ABRASIVE METAL NOSINGS

A. Stair Nosings at Cast-in-Place Concrete Stairs: Install with anchorage system to comply with manufacturer/fabricator's written instructions. Center nosings on tread widths to within 3 in (75 mm) of ends.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation.

3.14 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas; repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 055113
METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal stairs and supplementary items necessary for installation.

1. Metal pan stairs with concrete-filled metal pan treads and platforms.
2. Metal pan stairs with precast concrete treads.
3. Metal pan stairs with precast terrazzo treads.
4. Metal pan stairs with abrasive-coating-finished, formed-metal treads and platforms.
5. Metal plate stairs with abrasive-surfaced metal floor plate treads and platforms.
6. Metal plate stairs with checker-surfaced metal floor plate treads and platforms.
7. Metal grating stairs with metal grating treads and platforms.

B. Related Requirements:

1. Refer to Division 5 Section Pipe and Tube Railings for railings, guards, and gates.

1.2 DEFINITIONS

A. Unprotected Areas, Exterior Locations: Exterior areas exposed to the elements including but not limited to rain, snow, or ice.

B. Protected Areas, Interior and Exterior Protected Locations: Interior and protected exterior areas not exposed to the elements including but not limited to rain, snow, or ice.

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design

intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer/fabricator’s technical literature for each product and system indicated.

1. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance. Including but not limited to the following:

a. Abrasive nosings.
b. Post-installed anchors.
c. Shop primer products.
d. Nonslip-aggregate concrete finish.
e. Precast concrete treads.
f. Precast terrazzo treads.
g. Epoxy-resin-filled stair treads.
h. Nonshrink, nonmetallic grout.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
2. Include plan at each level.
3. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
4. Indicate profile and dimensions of precast terrazzo treads.
5. Indicate profile and dimensions of epoxy-resin-filled treads.

C. Samples for Verification: Each type and finish of the following items:

1. Nosing.
2. Precast terrazzo tread.
3. Epoxy-resin-filled tread.

1.5 INFORMATIONAL SUBMITTALS

A. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

C. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

D. Field Quality Control Reports: Written report of testing and inspection required by “Field Quality Control”.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

D. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1., the Building Code and Authorities Having Jurisdiction.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate installation of anchorages for metal stairs, railings, and guards.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

D. Schedule installation of railings and guards so wall attachments are made only to completed walls.

1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.

3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

B. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers/fabricators offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Alfab, Inc. (STAIRCO).
2. American Stair, Inc.
3. Pacific Stair Corporation.
4. Sharon Companies Ltd. (Duvinage LLC).

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
5. Deflection of treads, platforms, and framing members:

a. Typical Stairs: L/360 or 1/4 inch (6.4 mm), whichever is less.
b. Stairs with Stone or Ceramic Tile: L/720.

C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

E. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

2.4 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

1. Protected Areas, Interior and Exterior Protected Locations: Provide uncoated, non-galvanized steel including but not limited to plates, shapes, bars, sheets, rods and wire.
2. Unprotected Areas, Exterior Locations and where Indicated: Provide galvanized, steel including but not limited to plates, shapes, bars, sheets, rods and wire.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

D. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, either commercial steel, Type B, or structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.

E. Galvanized Steel Sheet: ASTM A653/A653M, G90 (Z275) coating, either commercial steel, Type B, or structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.

F. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

G. Abrasive-Surface, Steel Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material bonded to steel.

H. Checker-Surface, Steel Floor Plate: Steel plate with raised rhombic shapes on walking surface.

I. Steel Bars for Grating Treads: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.

J. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.

K. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.5 ABRASIVE NOSINGS

A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder.

1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.

a. Fabricate units in lengths necessary to accurately fit openings or conditions ending 1/8 in (3 mm) from face of stringer.

2. Nosings, Two-Piece Units: 3 inches (75 mm) wide, with subchannel for casting into concrete.
3. Exit Stairs at High Rise Buildings: Provide photoluminescent strips, minimum 1 in (25 mm) wide by full width of stair nosing, incorporated into abrasive surfaced nosings.

B. Manufacturers:

1. ACL Industries, Inc.
2. American Safety Tread Co., Inc.
3. Amstep Products.
4. Armstrong Products, Inc.
5. Balco Inc.
6. Granite State Casting Co.
7. Wooster Products Inc.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other listed manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: Wooster Products Inc.; Supergrit, WP-RN3SG; color as selected by Architect from manufacturer's full range of colors.
2. Manufacturer and Product - Exit Stairs at High Rise Buildings: Wooster Products Inc.; Supergrit, WP-RN3SG -NG; color as selected by Architect from manufacturer's full range of colors.

D. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

E. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.6 FASTENERS

A. General: Select fasteners for type, grade, and class required to comply with performance requirements and produce connections suitable for environmental exposure and anchoring stairs to other construction indicated.

1. Non-Galvanized Steel Components: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Steel Components: Hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Protected Areas, Interior and Exterior Protected Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Unprotected Areas, Exterior Locations: Hot-dip zinc-coated steel bolts, ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
3. Post-Tensioned Concrete Locations: Anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer written approval for all proposed anchors in post-tensioned concrete prior to installation.

2.7 PAINT MATERIALS

A. Coordination: Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Shop Primers for Paint: Provide primers that comply with Division 09 Section Painting.

1. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.

C. Shop Primers for High Performance Coatings: Provide primers that comply with Division 09 Section High Performance Coatings.

1. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.8 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

1. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.9 CONCRETE-FILLED METAL PAN TREADS AND PLATFORMS

A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi (20 MPa) and maximum aggregate size of 1/2 inch (13 mm) unless otherwise indicated.

B. Nonslip-Aggregate Concrete Finish - Unprotected Areas: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

C. Reinforcement: Plain steel, welded-wire reinforcement, 2 by 2 inches (50 by 50 mm) by 0.062-inch- (1.6-mm-) diameter steel wire; comply with ASTM A1064/A1064M, except for minimum wire size.

1. Provide galvanized reinforcement for exterior, unprotected installations and where indicated.

D. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
2. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.10 PRECAST CONCRETE TREADS

A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 5000 psi (35 MPa) and a total air content of not less than 4 percent or more than 6 percent.

B. Reinforcement: Galvanized, welded-wire reinforcement, 2 by 2 inches (50 by 50 mm) by 0.062-inch- (1.6-mm-) diameter steel wire; comply with ASTM A1064/A1064M, except for minimum wire size.

2.11 PRECAST TERRAZZO TREADS

A. Precast Terrazzo Stair Treads: Epoxy terrazzo units cast in maximum lengths possible. Comply with manufacturer's written instructions for fabricating precast terrazzo units in sizes and profiles indicated.

1. Epoxy Resin Matrix: Manufacturer's standard recommended for use indicated.
2. Aggregates: Comply with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.

a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M.
b. 24-Hour Absorption Rate: Less than 0.75 percent.
c. Dust Content: Less than 1.0 percent by weight.

3. Reinforcement: ASTM A615/A615M, Grade 60 (Grade 420) bars, as required by unit size, profile, and thickness.
4. Abrasive Inserts: 1/2-inch- (13-mm-) wide, silicon carbon/epoxy mixture.

a. Provide three inserts, 1/2 inch (13 mm) apart, with first insert located 1 inch (25 mm) from nosing at adjacent stair riser locations.

5. Color: As selected by Architect from manufacturer's standard color selections.

a. Finish: Honed.

6. Surface Sealer: Slip- and stain-resistant, penetrating sealer that is chemically neutral with pH factor between 7 and 8; does not affect color or physical properties of terrazzo type indicated; is recommend by sealer manufacturer for use with specified terrazzo; and complies with NTMA guide specification for terrazzo type applicable for this Project.

2.12 FABRICATION, GENERAL

A. General: Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.
3. Unprotected Areas, Exterior Locations and where Indicated: Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.

B. Shop Assembly: Assemble stairs in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.13 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual.

1. Stair Classification: Commercial Class unless more stringent requirements are indicated.

a. Metal Pan Stairs.

1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay.

b. Metal Pan Stairs - Abrasive-Coating-Finished, Formed-Metal Stairs.

1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay.

2. Stair Classification: Architectural Class unless more stringent requirements are indicated.

a. Architecturally Exposed Open Stairs.

1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.

3. Stair Classification: Service Class unless more stringent requirements are indicated.

a. Metal Floor Plate Stairs.

1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 4 - Good quality, uniform undressed weld with minimal splatter.

b. Metal Grating Stairs.

1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 4 - Good quality, uniform undressed weld with minimal splatter.

B. Stair Framing:

1. Stringers: Fabricate of steel plates or steel channels as indicated on Drawings.

a. Stringer Size: As required to comply with Performance Requirements and as indicated on Drawings.
b. Provide closures for exposed ends of channel and rectangular tube stringers.

2. Platforms: Construct of steel plates or steel channel headers and miscellaneous framing members as required to comply with Performance Requirements and as indicated on Drawings

a. Provide closures for exposed ends of channel and rectangular tube framing.

3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.

a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch (1.7 mm).

1. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
2. Attach abrasive nosings to risers.
3. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

D. Metal Pan Stairs - Abrasive-Coating-Finished, Formed-Metal: Form risers, subtreads, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.097 inch (2.5 mm).

1. Basis of Design Manufacturer and Product:

a. American Stair; FasTrack Treads with SafetyTread embedded photoluminescent nosing strips.
b. Color and Finish: As selected by Architect from manufacturer's standard colors.

2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
4. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.

E. Metal Floor Plate Stairs - Abrasive Surface: Form treads and platforms to configurations shown from rolled-steel abrasive-surface floor plate of thickness needed to comply with performance requirements, but not less than 1/8 inch (3 mm).

1. Form treads with integral nosing and back edge stiffener. Form risers from steel sheet not less than 0.097 inch (2.5 mm) thick, welded to tread nosings and stiffeners and to platforms.
2. Weld steel supporting brackets to stringers and weld treads to brackets.
3. Fabricate platforms with integral nosings matching treads and weld to platform framing.

F. Metal Floor Plate Stairs - Checker Surface: Form treads and platforms to configurations shown from rolled-steel checker-surface floor plate of thickness needed to comply with performance requirements, but not less than 1/8 inch (3 mm).

1. Form treads with integral nosing and back edge stiffener. Form risers from steel sheet not less than 0.097 inch (2.5 mm) thick, welded to tread nosings and stiffeners and to platforms.
2. Weld steel supporting brackets to stringers and weld treads to brackets.
3. Fabricate platforms with integral nosings matching treads and weld to platform framing.

G. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from welded steel or pressure-locked steel grating with openings in gratings no more than 1/2 inch (12 mm).

a. Surface: Serrated.

2. Fabricate grating treads with cast-abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections.

a. Secure treads to stringers with bolts.

3. Fabricate grating platforms with nosing matching that on grating treads.

a. Secure grating to platform framing by welding or with bolts.

2.14 FABRICATION OF STAIR RAILINGS AND GUARDS

A. Comply with applicable requirements in Division 05 Section Pipe and Tube Railings.

2.15 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish fabrications after assembly.
2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

B. Selections: As scheduled or as indicated in Design Selections.

2.16 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. Shop Priming:

1. Shop Primer for Galvanized Steel: Apply shop primer formulated for exterior use over zinc-coated metal stair components.

a. Preparation: Comply with requirements of painting system, but not less than minimum requirements of SSPC-SP 16 surface preparation specifications

2. Shop Primer for Uncoated Surfaces: Apply shop primer to uncoated surfaces of metal stair components.

a. Preparation: Comply with requirements of painting system, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications

3. Application: Comply with SSPC-PA 1, Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel, for shop painting.

a. Primer need not be applied to surfaces to be embedded in concrete or masonry.

C. Field-Applied Coatings: Paint all metal stairs unless noted otherwise.

1. Painting: Comply with Division 09 Section Painting.
2. High Performance Coatings: Comply with Division 09 Section High Performance Coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
2. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer/fabricator's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in Fabrication Article.

F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete.
2. Center nosings on tread width.
3. Coat concealed aluminum surfaces in contact with concrete with corrosion resistant paint.

G. Install precast concrete treads with adhesive supplied by manufacturer.

H. Install precast terrazzo treads according to manufacturer's written instructions.

3.5 INSTALLATION OF RAILINGS AND GUARDS

A. Comply with applicable requirements in Division 05 Section Pipe and Tube Railings.

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner may engage a qualified special inspector to perform special inspections and prepare reports:

1. Erection of metal stairs.
2. Testing agency will report test results promptly and in writing to Contractor and Architect.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.7 REPAIR

A. Touchup Painting:

1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint.

a. Painting: Comply with Division 09 Section Painting.
b. High Performance Coatings: Comply with Division 09 Section High Performance Coatings.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 055213
PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal railings and supplementary items necessary for installation.

1. Steel railings.
2. Aluminum railings.
3. Stainless steel railings.

B. Related Requirements:

1. Refer to Division 05 Section Metal Pan Stairs for steel tube railings associated with metal pan stairs.

1.2 DEFINITIONS

A. Unprotected Areas, Exterior Locations: Exterior areas exposed to the elements including but not limited to rain, snow, or ice.

B. Protected Areas, Interior and Exterior Protected Locations: Interior and protected exterior areas not exposed to the elements including but not limited to rain, snow, or ice.

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If

accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer/fabricator's technical literature for each product and system indicated.

1. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance. Including but not limited to the following:

a. Fasteners.
b. Post-installed anchors.
c. Handrail brackets.
d. Shop primer.
e. Nonshrink, nonmetallic grout.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

a. Show method of connecting and finishing members at intersections.

1.5 INFORMATIONAL SUBMITTALS

A. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

C. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.

C. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

D. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1., the Building Code and Authorities Having Jurisdiction.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate installation of anchorages for railings.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

C. Schedule installation of railings and guards so wall attachments are made only to completed walls.

1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep railing members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect railing members and packaged materials from corrosion and deterioration.

B. Repair or replace damaged materials or structures as directed.

C. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers/fabricators offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers and Products:

1. Alfab, Inc. (STAIRCO).
2. American Stair, Inc.
3. Pacific Stair Corporation.
4. Sharon Companies Ltd. (Duvinage LLC).

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance of Railings and Guards: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

C. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

2.4 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

1. Protected Areas, Interior and Exterior Protected Locations: Provide uncoated, non-galvanized steel including but not limited to pipe, tubes, plates, shapes, bars, sheets, rods and wire.
2. Unprotected Areas, Exterior Locations and where Indicated: Provide galvanized, steel including but not limited to pipe, tubes, plates, shapes, bars, sheets, rods and wire.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.5 STEEL RAILINGS

A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.

B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

D. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.6 ALUMINUM RAILINGS

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Tubing: ASTM B221 (ASTM B221M), Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.

E. Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.

F. Die and Hand Forgings: ASTM B247 (ASTM B247M), Alloy 6061-T6.

G. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.7 STAINLESS STEEL RAILINGS

A. Stainless Steel: Alloy Group 1 (A1) Type 304.

B. Stainless Steel: Alloy Group 2 (A4) Type 316.

C. Tubing: ASTM A554.

D. Pipe: ASTM A312/A312M.

E. Castings: ASTM A743/A743M.

F. Plate and Sheet: ASTM A240/A240M or ASTM A666.

2.8 FASTENERS

A. General: Select fasteners for type, grade, and class required to comply with performance requirements and produce connections suitable for environmental exposure and anchoring railings to other construction indicated.

1. Non-Galvanized Steel Components: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Steel Components: Hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
3. Aluminum Components: Stainless steel fasteners.
4. Stainless Steel Components: Stainless steel fasteners.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Protected Areas, Interior and Exterior Protected Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Unprotected Areas, Exterior Locations: Hot-dip zinc-coated steel bolts, ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
3. Post-Tensioned Concrete Locations: Anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer’s written approval for all proposed anchors in post-tensioned concrete prior to installation.

2.9 PAINT MATERIALS

A. Coordination: Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Shop Primers for Paint: Provide primers that comply with Division 09 Section Painting.

1. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.

C. Shop Primers for High Performance Coatings: Provide primers that comply with Division 09 Section High Performance Coatings.

1. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.

2.10 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

1. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.11 FABRICATION OF RAILINGS

A. NAAMM Railing Standard: Comply with NAAMM AMP 521, "Pipe Railing Systems Manual."

1. Metal Railings.

a. Locations, Typical:

1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay.

2. Metal Railings for Commercial Class Metal Stairs.

a. Metal Pan Stairs.

1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay.

3. Metal Railings for Architectural Class Metal Stairs.

a. Architecturally Exposed Open Stairs.

1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.

4. Metal Railings for Service Class Metal Stairs.

a. Metal Floor Plate or Metal Grating Stairs.

1) At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 4 - Good quality, uniform undressed weld with minimal splatter.

B. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

1. Join components by welding unless otherwise indicated.

C. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

D. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

E. Form work true to line and level with accurate angles and surfaces.

F. Fabricate connections that are exposed to weather in a manner that excludes water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

H. Connections: Fabricate railings with welded connections unless otherwise indicated.

I. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with cam-type, self-closing hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.

J. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.

K. Form changes in direction as follows:

1. By bending or by inserting prefabricated elbow fittings.

L. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

M. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

Q. Fixed Railing Posts: For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

R. Removable Railing Posts: For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.

1. Provide socket covers designed and fabricated to resist being dislodged.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish fabrications after assembly.
2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

B. Selections: As scheduled or as indicated in Design Selections.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Hot-dip galvanize steel railings, including hardware, after fabrication.
2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
3. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
4. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

B. Shop Priming:

1. Shop Primer for Galvanized Steel: Apply shop primer formulated for exterior use over zinc-coated metal stair components.

a. Preparation: Comply with requirements of painting system, but not less than minimum requirements of SSPC-SP 16 surface preparation specifications

2. Shop Primer for Uncoated Surfaces: Apply shop primer to uncoated surfaces of metal stair components.

a. Preparation: Comply with requirements of painting system, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications

3. Application: Comply with SSPC-PA 1, Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel, for shop painting.

a. Primer need not be applied to surfaces to be embedded in concrete or masonry.

4. For non-galvanized-steel railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.

C. Field-Applied Coatings: Paint all metal railings unless noted otherwise.

1. Painting: Comply with Division 09 Section Painting.
2. High Performance Coatings: Comply with Division 09 Section High Performance Coatings.

2.14 ALUMINUM FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Mill Finish: AA-M12, non-specular as fabricated.

C. Clear Anodic Finish: AAMA 611.

1. Exterior Locations: AA-M12C22A41, Class I, 0.018 mm or thicker.
2. Interior Locations: AA-M12C22A31, Class II, 0.010 mm or thicker.

D. Color Anodic Finish: AAMA 611.

1. Exterior Locations: AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
2. Interior Locations: AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
3. Color:

a. Light bronze.
b. Medium bronze.
c. Dark bronze.
d. Black.

E. Baked-Enamel or Powder-Coat Finish for Interior Locations: AAMA 2604 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

F. Fluoropolymer Finish for Exterior Locations: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

2.15 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces.
3. Remove embedded foreign matter and leave surfaces chemically clean.

C. Stainless Steel Finishes:

1. Directional Satin Finish: ASTM A480/A480, No. 4.
2. High-Luster Finish: ASTM A480/A480M, No. 7.
3. Mirror Finish: ASTM A480/A480M, No. 8.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 PREPARATION

A. General: Comply with manufacturer/fabricator's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF RAILINGS

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

B. Adjust railings before anchoring to ensure matching alignment at abutting joints.

C. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.5 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Fabrication Article, whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches (50 mm) beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches (150 mm) of post.

3.6 ANCHORING POSTS

A. Anchoring Post into Concrete:

1. Anchoring post: One of the following as indicated on Drawings:

a. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
b. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

2. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post.

B. Anchoring Post onto Concrete:

1. Anchoring post: As follows and as indicated on Drawings:

a. Attach flange to concrete using post-installed anchors in pre-drill holes, welded or attached with set screws to post.

C. Anchoring Posts onto Metal Surfaces:

1. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:

a. For steel railings, weld flanges to post and bolt to metal supporting surfaces.
b. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.
c. For stainless steel railings, weld flanges to post and bolt to supporting surfaces.

D. Removable Railings: Install removable railing sections, where indicated, in slip-fit stainless-steel sockets cast in concrete.

3.7 ATTACHING RAILINGS

A. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with clearance from inside face of handrail and finished wall surface as indicated.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

C. Install railing gates level, plumb, and secure for full opening without interference.

1. Attach hardware using tamper-resistant or concealed means.
2. Adjust hardware for smooth operation.

3.8 FIELD QUALITY CONTROL

A. Special Inspections: Owner may engage a qualified special inspector to perform special inspections and prepare reports:

1. Erection of pipe and tube railings.
2. Testing agency will report test results promptly and in writing to Contractor and Architect.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.9 REPAIR

A. Touchup Painting:

1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint.

a. Painting: Comply with Division 09 Section Painting.
b. High Performance Coatings: Comply with Division 09 Section High Performance Coatings.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.10 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 055300
METAL GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal gratings and supplementary items required for installation.

1.2 DEFINITIONS

A. Unprotected Areas: Exterior areas directly exposed to the elements such as rain, snow, or ice.

B. Protected Areas: Interior and exterior areas not directly exposed to the elements such as rain, snow, or ice.

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Provide templates for anchors and bolts specified for installation under other Sections.
2. For installed products indicated to comply with design loads, include shop drawings and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
2. AWS D1.3, "Structural Welding Code - Sheet Steel".
3. AWS D1.6, "Structural Welding Code - Stainless Steel".
4. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

D. Metal Bar Grating Standards: Comply with the following as appropriate:

1. NAAMM MBG 531, "Metal Bar Grating Manual".
2. NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual".

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate installation of anchorages for metal gratings. Furnish setting drawings, templates, and directions for installing anchorages, including concrete inserts, anchor bolts, and items with

integral anchors that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Alabama Metal Industries Corporation; a Gibraltar Industries company.
2. IKG Industries; a division of Harsco Corporation.
3. McNichols Co.
4. Ohio Gratings, Inc.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance: Engineer products and systems to withstand the effects of loads established by authorities having jurisdiction and applicable local building codes, including gravity loads and the following loads and stresses within limits and under conditions indicated. Contractor shall obtain required design data and identify loads accommodated on submittal drawings.

1. Floors, Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft. (2.87 kN/sq. m).
2. Floors, Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft. (4.79 kN/sq. m).
3. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 8000 lbf (35.60 kN), whichever produces the greater stress.
4. Floors for Light Manufacturing: Uniform load of 125 lbf/sq. ft. (6.00 kN/sq. m) or concentrated load of 2000 lbf (8.90 kN), whichever produces the greater stress.
5. Limit deflection to L/360 or 1/4 in (6 mm), whichever is less.

C. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

D. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.

C. Wire Rod for Bar Grating Crossbars: ASTM A 510 (ASTM A 510M).

2.5 STAINLESS STEEL MATERIALS

A. Stainless Steel:

1. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
2. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

2.6 ALUMINUM MATERIALS

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Shapes: ASTM B 221 / B 221M, alloys as follows:

1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. 6061-T1, for grating crossbars.

2.7 FASTENERS

A. Fastener Type and Material: Select fasteners for type, grade, and class required to produce connections suitable for anchoring gratings to other types of construction indicated and capable of withstanding design loads.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A/ F 568M, Property Class 4.6; with hex nuts, ASTM A 563/ A 563M; and, where indicated, flat washers.

C. Bolts and Nuts:

1. Regular hexagon-head annealed stainless-steel bolts, ASTM F 593/F 738M; with hex nuts, ASTM F 594/F 836M; and, where indicated, flat washers and as follows:

a. Alloy Group 1 (A1) for Type 304.

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563/ A 563M; and, where indicated, flat washers. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Plain Washers: Round carbon steel, ASME B18.22.1/ASME B18.22M.

F. Lock Washers: Helical, spring type carbon steel, ASME B18.21.1/ASME B18.21.2M.

2.8 ANCHORS

A. General: Provide anchors capable of sustaining, without failure, a load equal to 6 times load imposed when installed in unit masonry and 4 times load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

B. Cast-in-Place Anchors in Concrete: Bolts, washers, and shims as needed, either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel; hot-dip galvanized according to ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Stainless steel bolts, ASTM F 593/F 738M, and nuts, ASTM F 594/F 836M; and as follows:

a. Alloy Group 1 (A1) for Type 304.

2. Post-Tensioned Concrete Locations: Anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer‘s written approval for all proposed anchors in post-tensioned concrete prior to installation.

2.9 PAINT MATERIALS

A. Paint for Steel Gratings: As specified in Division 09 Section "Painting".

B. Galvanizing Repair Paint for Steel Gratings: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Bituminous Paint for Aluminum Gratings: ASTM D 1187, cold-applied asphalt emulsion.

2.10 ACCESSORY ITEMS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.11 FABRICATION, GENERAL

A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 in (0.8 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Shop-Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. Weld corners and seams continuously to develop full strength of member to comply with following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surfaces.

F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
2. Toeplate Height: 4 in (100 mm) unless otherwise indicated.

2.12 METAL BAR GRATINGS

A. Welded Steel Grating:

1. Bearing Bar Spacing: 1-3/16 in (30 mm) on center, except at walking surfaces.
2. Bearing Bar Depth: As required to comply with structural performance requirements.
3. Bearing Bar Thickness: As required to comply with structural performance requirements.
4. Crossbar Spacing: 4 in (100 mm) on center.
5. Traffic Surface: Plain.
6. Finish:

a. Protected Areas: Shop primed.
b. Unprotected Areas: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface.

B. Pressure-Locked, Stainless-Steel Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.

1. Bearing Bar Spacing: 1-3/16 in (30 mm) on center, except at walking surfaces.
2. Bearing Bar Depth: As required to comply with structural performance requirements.
3. Bearing Bar Thickness: As required to comply with structural performance requirements.
4. Crossbar Spacing: 4 in (100 mm) on center.
5. Finish: As specified elsewhere in this Section.

C. Pressure-Locked, Aluminum Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.

1. Bearing Bar Spacing: 1-3/16 in (30 mm) on center, except at walking surfaces.
2. Bearing Bar Depth: As required to comply with structural performance requirements.
3. Bearing Bar Thickness: As required to comply with structural performance requirements.
4. Crossbar Spacing: 4 in (100 mm) on center.
5. Finish: As specified elsewhere in this Section.

D. Metal Gratings in Walking Surfaces: Fabricate metal gratings with bearing bars spaced with 1/4 in (6 mm) maximum spacing between bars to meet ADA requirements. Arrange so that bearing bars are perpendicular to the dominant direction of travel.

E. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

1. Provide no fewer than four saddle clips for each grating section composed of rectangular bearing bars 3/16 in (5 mm) or less in thickness and spaced 15/16 in (24 mm) or more on center, with each clip designed and fabricated to fit over two bearing bars.
2. Furnish threaded bolts with nuts and washers for securing grating to supports.

F. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

G. Do not notch bearing bars at supports to maintain elevation.

2.13 CAST IRON TRENCH GRATINGS

A. Cast iron pan and grate for transverse drainage system.

1. Material: Gray Iron, Class 35 for heavy duty use.
2. Product Standard (Design Basis): Neenah Foundry Co. Model R-4996-A1.
3. Grate: Type P.
4. Frame: Type M.
5. Opening: 11.5 in (292 mm).
6. Location: Bottom of ramps at parking garage.

2.14 GRATING FRAMES AND SUPPORTS

A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 in (600 mm) on center and provide minimum anchor units in the form of steel straps 1-1/4 in (32 mm) wide by 1/4 in (6 mm) thick by 8 in (200 mm) long.

2.15 FINISHES, GENERAL

A. Finish Quality Standard: NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish fabrications after assembly.
2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.16 STEEL FINISHES

A. Unprotected Areas:

1. Galvanized Finish: Hot-dip galvanize according to following. For surfaces to be painted, do not quench or apply post galvanizing treatments that might interfere with paint adhesion. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

a. Steel and Iron Products: ASTM A 123.
b. Steel and Iron Hardware: ASTM A 153.

2. Cleaning: After galvanizing, thoroughly clean surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

B. Protected Areas:

1. Shop Priming: Comply with Division 09 Section Painting and as follows:

a. Preparation of Uncoated Surfaces: Prepare uncoated surfaces to comply with requirements of coating product to be used, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications and environmental exposure conditions of installed fabrications.

b. Application: SSPC-PA 1; apply shop primer to uncoated surfaces. Stripe paint corners, crevices, bolts, welds, and sharp edges.

C. Field-Applied Coatings: As specified in Division 09 Section Painting. Paint all steel gratings unless noted otherwise.

2.17 STAINLESS STEEL FINISHES

A. Stainless Steel Gratings: As-fabricated finish.

2.18 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF METAL GRATINGS, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; measured from established lines and levels.

C. Connections at Unprotected Areas: Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of units that

have been coated or finished after fabrication and are intended for bolted or screwed field connections or other means without further cutting or fitting.

D. Field Welding: Weld connections continuously to develop full strength of member to comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

F. Toeplates: Attach toeplates to gratings by welding at locations indicated.

G. Corrosion Protection for Aluminum Gratings: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.5 INSTALLATION OF METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Removable Grating Sections: Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach non-removable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.6 FIELD QUALITY CONTROL

A. Owner’s Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.7 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop

painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.

B. Galvanized Surfaces at Unprotected Areas: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 057300
ORNAMENTAL HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes ornamental handrails and, railings along with supplementary items necessary to complete their installation.

1. Metal railings.
2. Glass railings (or windscreens).

B. Related Section:

1. Division 05 Section "Pipe and Tube Railings" for handrails and railings fabricated from steel pipe and tube components.

1.2 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

B. Interior: Areas located in conditioned spaces.

C. Exterior: Areas exposed to the elements and areas located in unconditioned spaces.

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or

other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Manufacturer's product lines of railings assembled from standard components.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. For illuminated railings, include wiring diagrams and roughing-in details.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Each type of glass required.
3. Fittings and brackets.
4. Welded or brazed connections, as applicable.
5. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

1.5 INFORMATIONAL SUBMITTALS

A. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Product Test Reports: For tests performed by a qualified testing agency, in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358.

C. Field Quality Control Reports: Written report of inspection required by "Field Quality Control".

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

C. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by

dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

E. Safety Glazing Labeling: Permanently mark glass with certification label of the Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

   a. Architect.
   b. Contractor, including superintendent.
   c. Installer, including project manager and supervisor.
   d. If requested, Manufacturer's qualified technical representative.
   e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION AND SCHEDULING

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

C. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

D. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

a. Blum, Julius & Co., Inc.
b. Blumcraft of Pittsburg.
c. CraneVeyor Corp.
d. Laurence, C.R. Co., Inc.
e. Livers Bronze Co.
f. Newman Brothers, Inc.
g. Sterling Dula Architectural Products, Inc. Div. of Kane Manufacturing.
h. Trex Commercial Products.
i. VIVA Railings.

j. Wagner, R & B, Ins.; a division of the Wagner Companies.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Engineering, General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
2. Copper Alloys: 60 percent of minimum yield strength.
3. Stainless Steel: 60 percent of minimum yield strength.
4. Steel: 72 percent of minimum yield strength.
5. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

3. Structural Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.

a. Provide top rail with sufficient material and thickness to be used as a grounding element for lightning protection system.

D. Wind Loads: Wind Loads: For exterior glazed decorative metal railings, capable of withstanding the following wind loads in accordance with the IBC and ASTM E1300:

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.

E. Windborne Debris Impact Resistance: Comply with impact resistance testing requirements for Wind Zone.

F. Thermal Movements for Exterior Railings: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

G. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.4 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

1. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.

2.5 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

B. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 5005-H32 or Alloy 6061-T6 as required to meet specification and design performance requirements.

F. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.

G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

H. Stainless Steel Cable and Cable Fittings:

1. Basis of Design: As indicated or scheduled in Design Selections.
2. Cable, Configuration and Diameter: Wire cable made from wire complying with ASTM A492, Type 316.
3. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
4. Intermediate Cable Supports: Stainless steel flat bar, 1/4 by 1 inch (6.4 by 25.4 mm), predrilled.

I. Perforated Metal Infill Panels: Aluminum sheet, ASTM B209 (ASTM B209M), Alloy 6061-T6.

1. Basis of Design: As indicated or scheduled in Design Selections.

J. Woven-Wire Mesh Infill Panels: Intermediate-crimp, 2-inch (50-mm) woven-wire mesh, made from 0.162-inch (4.1-mm) nominal diameter aluminum wire complying with ASTM B211/B211M, Alloy 6061-T94.

1. Basis of Design: As indicated or scheduled in Design Selections.

2.6 COPPER ALLOYS

A. Copper and Copper Alloys, General: Provide alloys indicated and with temper to suit application and forming methods, but with strength and stiffness not less than Temper H01 (quarter hard) for plate, sheet, strip, and bars and Temper H55 (light drawn) for tube and pipe.

B. Extruded Shapes, Bronze: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).

C. Extruded Shapes, Brass: ASTM B 249/B 249M, Alloy UNS No. C36000 (free-cutting brass).

D. Extruded Shapes, Nickel Silver: ASTM B 249/B 249M, Alloy UNS No. C79600.

E. Seamless Pipe, Bronze: ASTM B 43, Alloy UNS No. C23000 (red brass, 85 percent copper).

F. Seamless Tube, Bronze: ASTM B 135 (ASTM B 135M), Alloy UNS No. C23000 (red brass, 85 percent copper).

G. Seamless Tube, Brass: ASTM B 135 (ASTM B 135M), Alloy UNS No. C26000 (cartridge brass, 70 percent copper).

H. Seamless Tube, Copper: ASTM B 75 (ASTM B 75M), Alloy UNS No. C12200 (phosphorous deoxidized, high residual phosphorous copper).

I. Castings, Bronze: Composition bronze castings complying with ASTM B 62, Alloy UNS No. C83600 (85-5-5-5 or No. 1 composition commercial red brass) or sand castings complying with ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze).

J. Castings, Brass: Sand castings complying with ASTM B 584, Alloy UNS No. C85200 (high-copper yellow brass).

K. Castings, Copper: ASTM B 824, with a minimum of 99.9 percent copper.

L. Castings, Nickel Silver: ASTM B 584, Alloy UNS No. C97300 (12 percent leaded nickel silver).

M. Plate, Sheet, Strip, and Bars; Bronze: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).

N. Plate, Sheet, Strip, and Bars; Brass: ASTM B 36/B 36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper).

O. Plate, Sheet, Strip, and Bars; Copper: ASTM B 152/B 152M, Alloy UNS No. C11000 (electrolytic tough pitch copper) or Alloy UNS No. C12200 (phosphorous deoxidized, high-residual phosphorous copper).

P. Stainless Steel Cable and Cable Fittings:

1. Basis of Design: As indicated or scheduled in Design Selections.
2. Cable, Configuration and Diameter: Wire cable made from wire complying with ASTM A492, Type 316.
3. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
4. Intermediate Cable Supports: Stainless steel flat bar, 1/4 by 1 inch (6.4 by 25.4 mm), predrilled.

2.7 STAINLESS STEEL

A. Railings:

1. Tubing: ASTM A 554, Grade MT 304.
2. Pipe: ASTM A 312/A 312M, Grade TP 304.
3. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
4. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.
5. Bars and Shapes: ASTM A 276, Type 304.

B. Railings:

1. Tubing: ASTM A 554, Grade MT 316 or 316L.
2. Pipe: ASTM A 312/A 312M, Grade TP 316 or 316L.
3. Castings: ASTM A 743/A 743M, Grade CF 8M or CF 3M.
4. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 316 or 316L.
5. Bars and Shapes: ASTM A 276, Type 316 or 316L.

C. Stainless Steel Cable and Cable Fittings:

1. Basis of Design: As indicated or scheduled in Design Selections.
2. Cable, Configuration and Diameter: Wire cable made from wire complying with ASTM A492, Type 316.
3. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
4. Intermediate Cable Supports: Stainless steel flat bar, 1/4 by 1 inch (6.4 by 25.4 mm), predrilled.

D. Perforated Metal Infill Panels: Stainless steel sheet, ASTM A240/A240M or ASTM A666.

1. Basis of Design: As indicated or scheduled in Design Selections.

E. Woven-Wire Mesh Infill Panels: Intermediate-crimp, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter stainless steel wire complying with ASTM A580/A580M.

1. Basis of Design: As indicated or scheduled in Design Selections.

F. Expanded Metal Infill Panels: ASTM F1267, Class 3 (corrosion-resisting steel), made from stainless steel sheet complying with ASTM A666.

1. Basis of Design: As indicated or scheduled in Design Selections.

2.8 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

E. Stainless Steel Cable and Cable Fittings:

1. Basis of Design: As indicated or scheduled in Design Selections.
2. Cable, Configuration and Diameter: Wire cable made from wire complying with ASTM A492, Type 316.

3. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
4. Intermediate Cable Supports: Stainless steel flat bar, 1/4 by 1 inch (6.4 by 25.4 mm), predrilled.

F. Perforated Metal Infill Panels:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, or hot-rolled steel sheet, ASTM A1011/A1011M, commercial steel Type B.

a. Basis of Design: As indicated or scheduled in Design Selections.

2. Galvanized-Steel Sheet: ASTM A653/A653M, G90 (Z275) coating, commercial steel Type B.

a. Basis of Design: As indicated or scheduled in Design Selections.

G. Woven-Wire Mesh Infill Panels: Intermediate-crimp, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter steel wire complying with ASTM A510/A510M.

1. Basis of Design: As indicated or scheduled in Design Selections.

H. Expanded Metal Infill Panels: ASTM F1267, Class 1 (uncoated).

1. Basis of Design: As indicated or scheduled in Design Selections.

2.9 GLASS AND GLAZING PRODUCTS, GENERAL, MATERIALS

A. Comply with Section 088000 Glazing.

B. Glazing Publications: Comply with written instructions of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA/GANA Publications: GANA Laminated Glazing Reference Manual and GANA Glazing Manual.

C. Safety Glazing: Glazing shall comply with 16 CFR 1201, Category II.

D. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.<Insert manufacturer's name and product.>

E. Glazing Cement and Accessories - Structural Glass Balusters or Screens: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.

1. Glazing Cement: Non-shrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.

F. Glazing Gaskets - Glass Infill Panels or Screens: Glazing gaskets and related accessories recommended or supplied by railing manufacturer for installing glass infill panels in post-supported railings.

2.10 GLASS HANDRAILS, GUARDS OR SCREENS

A. Laminated Glass Handrails, Guards or Screens: ASTM C1172, Type II with two plies of glass bonded together by an interlayer.

1. Construction: Laminate glass with ionoplast polymer interlayer to comply with interlayer manufacturer's written instructions.
   a. Basis of Design: Kuarary; SentryGlas Ionoplast; clear.
2. Interlayer Thickness: 0.060 inch (1.52 mm) minimum, thickness as required for intended use.
3. Kind: LHS (laminated heat strengthened).
4. Glass Type:
   a. Selection: As indicated or scheduled in Design Selections.
5. Glass Plies: Thickness required by structural loads, but not less than 6.0 mm thick each ply.

2.11 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
   1. Aluminum Components for Interior Railings: Type 304 stainless-steel fasteners.
   2. Aluminum Components for Exterior Railings: Type 316 stainless-steel fasteners.
   3. Copper-Alloy (Bronze) Components: Silicon bronze (Alloy 651 or Alloy 655) fasteners where concealed; muntz metal (Alloy 280) fasteners where exposed.
   4. Copper-Alloy (Brass) Components: Silicon bronze (Alloy 651 or Alloy 655) fasteners where concealed; brass (Alloy 260 or Alloy 360) fasteners where exposed.
   5. Stainless-Steel Components: Type 304 stainless-steel fasteners.
   6. Stainless-Steel Components: Type 316 stainless-steel fasteners.
   7. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
   8. Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
   9. Dissimilar Metals for Interior Railings: Type 304 stainless-steel fasteners.
   10. Dissimilar Metals for Exterior Railings: Type 316 stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.
   1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

E. Post-Installed Anchors: Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.12 MISCELLANEOUS MATERIALS

A. Wood Rails:

1. Clear, straight-grained hardwood rails secured to metal subrail as indicated on Drawings.

a. Comply with Section 064023 Interior Architectural Woodwork.

B. Electrical Components for Illuminated Railings: Provide internal, fluorescent light fixtures and electrical components, required as part of illuminated railings, that comply with NFPA 70 and that are listed and labeled by UL.

C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. Aluminum Railings: For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

D. Brazing Rods for Copper-Alloy Railings: For copper-alloy railings, provide type and alloy as recommended by producer of metal to be brazed and as required for color match, strength, and compatibility in fabricated items.

E. Lacquer for Copper Alloys: Clear acrylic lacquer specially developed for coating copper-alloy products.

F. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

G. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

I. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

J. Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Anchoring Cement: Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.13 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 in (0.8 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

E. Form work true to line and level with accurate angles and surfaces.

F. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

H. Connections: Fabricate railings with welded or Non-welded connections unless otherwise indicated.

I. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

J. Brazed Connections for Copper-Alloy Railings: Connect copper-alloy railings by brazing. Cope components at connections to provide close fit, or use fittings designed for this purpose. Braze corners and seams continuously.

1. Use materials and methods that match color of base metal, minimize distortion, and develop maximum strength and corrosion resistance.
2. Remove flux immediately.
3. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and brazed surface matches contours of adjoining surfaces.

K. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

L. Form changes in direction by flush bends or by inserting prefabricated flush-elbow fittings. Where applicable, by radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

M. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

N. Close exposed ends of hollow railing members with prefabricated end fittings.

O. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 in (6 mm) or less.

P. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. Interior Installations at Plaster or Gypsum Board Partitions: At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

Q. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

R. For railing posts set in concrete, provide steel sleeves not less than 6 in (150 mm) long with inside dimensions not less than 1/2 in (12 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

S. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.14 FABRICATION OF GLASS PANELS, BALUSTRADES OR SCREENS

A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.

B. Glass-Infill Panels or Screens: Provide laminated, heat-strengthened glass-infill panels for both straight and curved sections.

1. Edge Finish: Clean-cut or flat-grind edges to produce smooth, square edges with slight chamfers at junctions of edges and faces.

C. Structural Glass Balusters or Screens: Provide laminated, heat-strengthened structural glass balusters for both straight and curved sections.

1. Edge Finish: Grind smooth and flat polish exposed edges of glass, including those at open joints, to produce smooth, square edges with glass edge finishes.
2. Factory-bond structural glass balusters to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement or sealant to comply with manufacturer's written instructions, unless field glazing is standard with manufacturer.
3. Fabricate structural glass balusters to maintain equal length glass widths and uniform spacing of 1/2 inch (13 mm) between glass balusters.

2.15 ILLUMINATED RAILINGS

A. General: Comply with requirements in this Section for aluminum railings with welded connections.

B. Illuminated Units: Provide internal illumination using concealed, internally wired, fluorescent-strip fixture system to illuminate walking surfaces adjacent to railings without light leaks. Make provisions for servicing and for concealed connection to electric service. Coordinate electrical characteristics with those of the power supply provided.

1. Fluorescent Tubes: Provide number of tubes indicated or required by railing length.
2. Diffusers: UV-stabilized acrylic diffusers matching profile of railings.
3. Ballasts: Energy-saving, high power factor, Class P, electromagnetic type; designed for use with high-output lamps, and with automatic-reset thermal protection. Ballasts comply with ANSI C82.1, bear Certified Ballast Manufacturer Certification labels, and are rated for 0 deg F (minus 17 deg C) starting temperature.

2.16 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products", the Aluminum Association and AAMA / FGIA for recommendations for applying and designating finishes.

1. Selections: As scheduled or as indicated in Design Selections.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.17 ALUMINUM FINISHES

A. Mechanical Finish: AA-M3x (Mechanical Finish: as specified); sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.

B. Clear Anodic Finish at Interior Installations: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

C. Clear Anodic Finish at Exterior Installations: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

D. Color Anodic Finish at Interior Installations: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

E. Color Anodic Finish at Exterior Installations: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

F. Fluoropolymer Finish: High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

G. Baked-Enamel or Powder-Coat Finish: Finish complying with AAMA 2604, minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

H. Siliconized Polyester Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.

2.18 COPPER-ALLOY FINISHES

A. Buffed Finish: M21 (Mechanical Finish: buffed, smooth specular).

B. Hand-Rubbed Finish: M31-M34 (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed).

C. Medium-Satin Finish: M32 (Mechanical Finish: directionally textured, medium satin).

D. Fine-Matte Finish: M42 (Mechanical Finish: Non-directional finish, fine matte).

E. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).

1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

F. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).

1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

G. Medium-Satin Finish, Lacquered: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below).

1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

H. Fine-Matte Finish, Lacquered: M42-O6x (Mechanical Finish: Non-directional finish, fine matte; Coating: clear organic, air drying, as specified below).

1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

I. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide), with color matching Architect's sample.

J. Patina Conversion Coating: M36-C12-C52 (Mechanical Finish: directionally textured, uniform; Chemical Finish: Non-etched cleaned, degreased; Chemical Finish: conversion coating, ammonium sulfate), with color matching Architect's sample.

2.19 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces.
3. Remove embedded foreign matter and leave surfaces chemically clean.

C. Stainless Steel Finishes:

1. Directional Satin Finish: ASTM A480/A480M, No. 4
2. High-Luster Finish: ASTM A480/A480M, No. 7.
3. Mirror Finish: ASTM A480/A480M, No. 8.

D. Sputter-Coated Finish: Titanium nitride coating deposited by magnetic sputter-coating process over indicated mechanical finish.

2.20 STEEL AND IRON FINISHES

A. Galvanized Railings for Exterior Installations:

1. General:

a. Hot-dip galvanize steel and iron railings, including hardware, after fabrication.
b. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
c. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
d. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
e. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

2. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
3. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner and as follows:

a. Comply with SSPC-SP 16.

B. Non-Galvanized Railings for Interior Installations:

1. For non-galvanized-steel railings, provide Non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
2. Preparing Non-Galvanized Railings for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:

a. Exterior Railings: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
b. Railings Indicated to Receive Primers Specified in Section 099600 High-Performance Coatings: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
c. Interior and Other Railings: SSPC-SP 7/NACE No. 4, Brush-off Blast Cleaning .

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with primers specified in Division 09 Section Painting.
2. Shop prime uncoated railings with primer specified in Division 09 Section High-Performance Coatings.
3. Do not apply primer to galvanized surfaces.

D. Shop-Painted Finish:

1. Comply with Division 09 Section Painting.
2. Comply with Division 09 Section High-Performance Coatings.

E. Field-Painted Finish:

1. Comply with Division 09 Section Painting.
2. Comply with Division 09 Section High-Performance Coatings.

F. Powder-Coat Finish for Non-Galvanized Steel and Iron Installations: Prepare, treat, and coat non-galvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).

G. Powder-Coat Finish for Galvanized Steel and Iron Installations: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Interior Installations: Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Comply with Drawings and manufacturer's written instructions for installing glazed decorative metal railings, accessories, and other components.

B. Windborne-Debris Resistance: Anchor glazed decorative metal railings to structure using anchoring method, fastener type, and fastening frequency identical to that used in windborne-debris-resistance testing.

C. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 in in 3 feet (1.5 mm in 1 m).
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 in in 12 feet (6 mm in 3.6 m).

D. Control of Corrosion for Aluminum and Copper Alloys: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with bituminous paint.

E. Adjust railings before anchoring to ensure matching alignment at abutting joints.

F. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.5 RAILING CONNECTIONS

A. Non-welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 in (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 in (150 mm) of post.

3.6 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, non-metallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, non-metallic grout or anchoring

cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

D. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. Aluminum Railings: For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.
2. Copper-Alloy Railings: For copper-alloy railings, attach posts as indicated using fittings designed and engineered for this purpose.
3. Stainless Steel Railings: For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
4. Steel Railings: For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.7 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with flanges connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using non-welded connections.

C. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets with 1-1/2 in (38 mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.8 INSTALLING GLASS BALUSTERS OR SCREENS

A. Structural Glass Railings or Screens: Install assembly to comply with railing manufacturer's written instructions.

1. Attach base channel to building structure, then insert and connect factory-fabricated and -assembled glass panels if glass was bonded to base and top rail channels in factory.
2. For field-assembled balusters, attach base channel to building structure, insert glass in base channel, and bond with glazing cement or sealant.

   a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement.
   b. Fill remaining space in base channel with glazing cement for uniform support of glass.

3. Adjust spacing of glass panels so gaps between panels are equal before securing in position.

4. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

B. Post-Supported Glass Railings with Glass Infill Panels or Screens:

1. Install assembly to comply with railing manufacturer's written instructions and with requirements in other articles.
2. Erect posts and other metal railing components, then set factory-cut glass panels.
3. Do not cut, drill, or alter glass panels in field. Protect edges from damage.

3.9 REPAIR

A. Touchup Painting: Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint.

1. Comply with Division 09 Section Painting.
2. Comply with Division 09 Section High-Performance Coatings

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Special Inspections: Owner may engage a qualified special inspector to perform special inspections and prepare reports:

1. Erection of pipe and tube railings.
2. Testing agency will report test results promptly and in writing to Contractor and Architect

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.11 CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

B. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.

C. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

D. Clean wood rails by wiping with a damp cloth and then wiping dry.

3.12 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

3.13 FINISH SCHEDULE

A. Ornamental Handrails and Railings

1. Metal Railing: Aluminum

a. Finish Type: High-Performance Organic Fluoropolymer.
b. Finish Type: Baked Enamel or Powder-coat.
c. Finish Type: Siliconized Polyester.
d. Coating Color:

1) Selection:
2) Match Architect's Sample.
3) As selected by Architect from manufacturers standards.

2. Metal Railing: Aluminum

a. Finish Type: Clear Anodized.
b. Finish Type: Color Anodized.

1) Color: Champagne.
2) Color: Light bronze.
3) Color: Medium bronze.
4) Color: Dark bronze.
5) Color: Black.
6) Color: Match Architect's sample.
7) Color: As selected by Architect from manufacturers standards

3. Metal Railing: Steel

a. Finish Type: Powder-Coat.
b. Finish Type: High-Performance Organic Fluoropolymer.
c. Coating Color:

1) Selection:
2) Match Architects Sample.
3) As selected by Architect from manufacturers standards.

4. Glass Railing:

a. Top Rail Material:
b. Finish:
c. Color:
d. Glass Type: GLXX

5. OHR01 - Metal Railing:

a. Material:
b. Finish:

c. Color:

6. OHR02 - Glass Handrails:

a. Top Rail Material:
b. Finish:
c. Color:
d. Glass Type: GLXX

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 061053
MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Miscellaneous rough carpentry and supplementary items necessary for installation.

1. Preservative treated wood materials.
2. Fire retardant treated wood materials
3. Composite plastic lumber materials.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Preservative-Treated Wood: Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Fire-Retardant-Treated Wood: Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

a. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.

3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.6 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Material Compatibility: Provide materials that are compatible with one another under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

C. Structural Loads: Installed materials and fabrications shall withstand loads within limits of allowable working stresses of the materials involved under conditions indicated, including but not limited to, requirements established by authorities having jurisdiction and applicable building codes.

D. Miscellaneous Rough Carpentry within Roofing System Assemblies: Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing system assembly and flashings shall be fabricated and installed to withstand specified uplift pressures and thermally induced movement without contributing to failure of roofing system or flashings.

E. Surface Burning Characteristics for Fire-Retardant-Treated Wood: Products and construction identical to assemblies tested for fire resistance according to ASTM E 84/NFPA 255/UL 723 and included under Category BPVV published in Underwriters Laboratories, Inc. (UL) "Fire Resistance Directory"; or listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

2.2 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC4a.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application Schedule: Treat miscellaneous carpentry items indicated on Drawings and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, air water barriers, and waterproofing.

   a. Contractor Option - Untreated Wood within Roofing System Assemblies: Contractor may use untreated wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing assemblies that are concealed within the roofing membrane.

2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Identification: Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Concealed Wood Blocking: Chemical formulations for fire retardant treatment to contain a compatible, non-bleed, light fast, colored dye to identify and indicate treatment.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application Schedule: Treat miscellaneous carpentry items indated on Drawings and the following:

1. Concealed blocking within interior partitions.
2. Plywood backing panels supporting equipment at interior locations.

2.5 LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.
4. Furring.
5. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:

1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods, No. 2 Common grade; NELMA.
5. Northern species, No. 2 Common grade; NLGA.
6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

1. Panel Grades: According to installation location.

a. A-C, exposed at occupied interior locations.
b. B-C, exposed at mechanical and electrical equipment rooms.

2.7 COMPOSITE PLASTIC LUMBER

A. Composite Plastic Lumber, General: Products acceptable to authorities having jurisdiction with current model code evaluation reports that show compliance with building code in effect for Project for indicated type of construction.

1. Allowable loads and spans, as documented in evaluation reports or in information referenced in evaluation reports, shall not be less than design loads and spans indicated.

B. Composite Plastic Lumber: Solid shapes made from a mixture of cellulose fiber and polyethylene or polypropylene.

1. Size: As indicated on drawings.
2. Surface Texture and Color: As selected by Architect from manufacturer's full range.
3. Acceptable Manufacturers:

a. Tamko Building Products.
b. TimberTech.
c. Trex Company, Inc.
d. Universal Forest Products.

2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Unless indicated otherwise, where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

a. Contractor Option - Untreated Wood within Roofing System Assemblies: Provide fasteners with Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening to Metal Framing: ASTM C1002 for drywall studs and ASTM C954 for structural studs, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, as appropriate for the substrate.

1. Mechanical Anchors in Masonry or Concrete: ICC-ES AC01 or ICC-ES AC193.
2. Adhesive Anchors in Masonry or Concrete: ICC-ES AC58 or ICC-ES AC308.
3. Material:

a. Interior Locations: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5, unless indicated otherwise.
b. Exterior Locations and where Stainless Steel is Indicated: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or A4).

2.9 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products, fabrications, and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

C. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated.

1. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.

G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the requirements of authorities having jurisdiction and the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

a. Select fasteners of appropriate size, type, and length that will not fully penetrate members where opposite side will be exposed to view or will receive finish

materials. Make tight connections between members. Predrill members when necessary to avoid splitting wood while installing fasteners. Do not countersink nail heads, unless otherwise indicated. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

2. ICC-ES evaluation report for fastener.

K. Install composite plastic lumber per manufacturer's written instructions.

3.3 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.4 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.5 PROTECTION

A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 061643
EXTERIOR GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exterior gypsum sheathing products and supplementary items necessary for installation.

B. Related Section:

1. Refer to Division 7 for applicable Air and Water Barrier system and related requirements. Ensure compatibility of joint treatment components with Air and Water Barrier system.

1.2 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms not defined in this Section or in other referenced quality standards.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.

d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

B. Exposure Limitation: Exterior gypsum sheathing shall not be exposed to weather for more than 180 days.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1. Ensure compatibility of joint treatment components and installation requirements with Air and Water Barrier systems incorporated into project.

1.10 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer’s standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor defects for a period of 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not

listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Exterior Gypsum Sheathing Boards:

1. Generic Type: Glass-mat faced exterior gypsum sheathing board.
2. Material Quality Standard: ASTM C 1177 / C 1177M, Type X.
3. Description: Paperless, treated, water resistant, noncombustible, gypsum core with inorganic glass mat partially or completely embedded on both faces; 5/8 in (15 mm) thick. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.
4. Manufacturers and Products:

a. American Gypsum; M-Glass Exterior Sheathing.
b. CertainTeed Corporation; GlasRoc Sheathing, Type X.
c. Georgia-Pacific Gypsum LLC; DensGlass Fireguard Type X Sheathing.
d. National Gypsum Company; Gold Bond Brand eXP Fire-Shield Extended Exposure Sheathing.
e. United States Gypsum Company (USG); Securock Firecode Type X Glass-Mat Sheathing.

C. Vertical Cover Boards (Back of Parapet) at Roofing: Provide same product used for horizontal roof cover boards.

1. Generic Type: Exterior sheathing board specifically manufactured for use beneath roofing systems.
2. Material Quality Standard: ASTM C 1177 / C 1177M, Type X.
3. Description: Non-combustible moisture-resistant board with non-asphaltic coatings; 5/8 in (15 mm) thick. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.
4. Manufacturers and Products:

a. Georgia-Pacific Gypsum LLC; DensDeck Prime.
b. USG; SECUROCK Gypsum-Fiber Roof Board.
c. Georgia-Pacific Gypsum LLC; DensDeck StormX Prime.

D. Horizontal Roof Cover Boards: As specified in Division 07 Section for roofing membrane.

E. Screw Fasteners:

1. Material Quality Standards:

a. Metal Framing Members less than 0.030 in (0.75 mm) Thick: ASTM C 1002, Type S.

b. Metal Framing Members from 0.033 in to 0.112 in (0.79 mm to 2.9 mm) Thick: ASTM C 954, Type S-12.

2. Product Description - Standard Applications: Bugle head, self-drilling, self-tapping, steel screws with Phillips-head recess of size, holding power, and other properties recommended by manufacturer; minimum 1 in (25 mm) long; with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
3. Product Description - High Moisture / Humidity Applications: Bugle head, self-drilling, self-tapping, stainless steel screws with Phillips-head recess of size, holding power, and other properties recommended by manufacturer; minimum 1 in (25 mm) long.
4. Limitation: Nails and staples are not permitted.

F. Joint and Penetration Treatment Materials:

1. General: Joint and penetration treatment materials shall be compatible with and recommended by gypsum sheathing manufacturer and air / water barrier manufacturer for application indicated.
2. Air Barrier Liquid Membrane: Liquid detail and substrate patching membrane for use with sheathing tape at joints and penetrations and for covering exposed fasteners.

a. Sheathing Tape: Type recommended by sheathing manufacturer and air / water barrier manufacturer for use with air barrier liquid membrane in sealing joints and penetrations in glass-mat gypsum sheathing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standard: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. GA-253.
2. ASTM C 1280.
3. Respective manufacturer’s written installation instructions.
4. Accepted submittals.
5. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Installation of Exterior Gypsum Sheathing Boards and Back of Parapet Boards:

1. Install boards with coated face out, with panel lengths oriented vertically or horizontally as recommended by manufacturer, with vertical edges centered over flanges of studs, with edges and ends fitted tightly together.
2. Do not install imperfect, damaged, wet, or damp boards.
3. Cut boards at penetrations, edges, and other obstructions of the Work; fit tightly against abutting construction with 1/4-inch maximum gap, except provide maximum 3/8 in (10 mm) setback where boards abuts structural elements or materials that may retain moisture.
4. Coordinate installation of boards with flashing and joint treatment so materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
5. Install screws at perimeter and within field to each stud approximately 8 in (200 mm) on centers; set back minimum 3/8 in (10 mm) from edges and ends; apply so screw heads bear tightly against board face but do not cut into facing.
6. Do not bridge building expansion joints or deflection joints with boards; cut and space edges to match spacing of structural support elements.

B. Joint and Penetration Treatment at Exterior Gypsum Sheathing Boards and Back of Parapet Boards:

1. Coordinate installation with applicable air / water barrier system to ensure compatibility of joint and penetration treatment.
2. Apply liquid membrane to joints and fasteners and trowel flat. Apply liquid membrane sufficiently to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
3. Apply sheathing tape to glass-mat gypsum sheathing joints. Apply and trowel liquid membrane to embed entire face of tape. Apply liquid membrane to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

3.6 PROTECTION

A. Procedures: Protect products and systems from damage during installation and remainder of construction period according to manufacturer's instructions. Remove and replace products that are exposed to weather for more than number of days allowed by manufacturer.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 064023
INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Shop-finished interior architectural woodwork and supplementary items necessary for installation.

B. Simulated Stone Countertops: Refer to Division 12 Section "Simulated Stone Countertops" for solid surfacing, quartz agglomerate, or cultured marble countertops incorporated into work specified in this Section. Simulated stone trim is specified in this Section.

1.2 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

B. Stair Work and Rails: Rough carriages for stairs are a part of interior architectural woodwork. Platform framing, headers, partition framing, and other rough framing associated with stairwork are specified in Division 06 Section "Miscellaneous Rough Carpentry".

C. Exposed Surfaces, Semi-Exposed Surfaces, Concealed Surfaces, Types of Cabinet Construction, and other related terms are defined in referenced quality standards.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Wood Veneered Items: Include finishing materials and processes.
3. Fire Retardant Treated Wood: Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
4. Wood Paneling with Transparent Finish: For paneling noted or schedule to be blueprint matched work, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples for Verification:

1. Items with Transparent Finish:

a. Lumber with or for transparent finish, not less than 50 sq. in. (300 sq. cm) or 5 in (125 mm) wide by 24 in (600 mm) long, for each species and cut, finished on 1 side and 1 edge.

b. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
c. Veneer-faced panel products with or for transparent finish, 8 in by 10 in (200 mm by 250 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.

2. Items with Opaque Finish:

a. Lumber and panel products with shop-applied opaque finish, 50 sq. in. (300 sq. cm) for lumber and 8 in by 10 in (200 mm by 250 mm) for panels, for each finish system and color, with 1/2 of exposed surface finished.

3. Items with Plastic Laminate Finish:

a. Plastic laminates, 8 in by 10 in (200 mm by 250 mm), for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.

4. Simulated Stone Trim: 6 in (150 mm) long.
5. Cabinets:

a. Corner Piece: Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 in (450 mm) high by 18 in (450 mm) wide by 6 in (150 mm) deep.
b. Cabinet Hardware and Accessories: Exposed cabinet hardware and accessories, one unit for each type and finish.
c. Countertops: Section of countertop showing top, front edge, and backsplash construction.

6. Standing and Running Trim: Corner piece showing miter joints.

1.4 INFORMATIONAL SUBMITTALS

A. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates or WI certified compliance certificates.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

1. Woodwork Fabricator Certification: Certified participant in AWI's Quality Certification Program or licensee of WI's Certified Compliance Program.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Certification: Certified participant in AWI's Quality Certification Program or licensee of WI's Certified Compliance Program.

C. Source Limitations for Wood Veneered Items: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and wood doors with face veneers that are sequence matched with woodwork.

D. Quality Standard: Unless otherwise indicated, comply with "Architecural Woodwork Standards" for standards and for grades of interior architectural woodwork indicated for construction, finish, installation and other requirements:

1. Provide manufacturer certification indicating that woodwork complies with requirements of referenced quality standards.
2. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.
3. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated or required, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

G. Mock-ups, Cabinets:

1. One full-size sample of finished base cabinet unit complete with hardware, doors, and drawers, but exclusive of countertop.
2. One full-size sample of finished wall-mounted cabinet unit complete with hardware, doors, and adjustable shelves.
3. Accepted sample units will be used as a standard for judging the completed work. Unless otherwise directed, accepted sample units may be incorporated in work. If not incorporated in work, retain accepted sample units at Project site until completion of work and remove sample units from premises when directed by Architect.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

   a. Architect.

b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 PREFERRED WOODWORK FABRICATORS

A. Fabricators:

1. Fetzer Architectural Woodwork.
2. Mike Reznikoff Custom Furniture.
3. Paramount Millwork Corporation.
4. Anton Woodwork.

2.3 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Provide materials that comply with requirements of "Architectural Woodwork Standards" quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

2.4 MATERIALS

A. Wood Species and Cut for Transparent Finish:

1. Selections: As scheduled or as indicated in Design Selections.

B. Wood Species for Opaque Finish: Any closed-grain hardwood unless indicated otherwise.

C. Fire Retardant Wood Products for Paneling:

1. Medium-Density Fiberboard: ANSI A208.2, minimum Grade 130-MR50, made with binder containing no added urea formaldehyde.
2. Particleboard: ANSI A208.1, Industrial Grade M-2 Exterior Glue, made with binder containing no added urea formaldehyde, 43 pcf (753kgm3) Density.
3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

D. Wood Products for Cabinets:

1. Hardboard for Vertical Dividers Only: AHA A135.4, tempered, smooth two sides, 1/4 in (6 mm) minimum thickness unless indicated otherwise.
2. Medium-Density Fiberboard: ANSI A208.2, minimum Grade 130-MR50, made with binder containing no added urea formaldehyde.
3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no added urea formaldehyde.
4. Softwood Plywood: DOC PS 1.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Fire-Rated Laminates: Where indicated or scheduled; NEMA LD 3, grades as follows:

a. Vertical Surfaces: General Purpose Type 604 (VGF), 0.032 in (0.79 mm) thick.
b. Horizontal Surfaces: General Purpose Type 605 (HGF) 0.048 in (1.2 mm) thick.

2. Manufacturers:

a. Formica Corporation.
b. International Paper.
c. Lamin-Art, Inc.

d. Nevamar Company, LLC; Decorative Products Div.
e. Pioneer Plastics Corp.
f. Westinghouse Electric Corp.; Specialty Products Div.
g. Wilsonart International; Div. of Premark International, Inc.

3. Colors, Patterns, and Finishes:

a. Selections: As scheduled or as indicated in Design Selections.

F. Chemical-Resistant, High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP, and as follows:

1. Laminate has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.9.5:

a. Nitric Acid (30 Percent): Moderate effect.
b. Sulfuric Acid (77 Percent): Moderate effect.
c. Hydrochloric Acid (37 Percent): Moderate effect.
d. Phosphoric Acid (75 Percent): No effect.
e. Acetic Acid (98 Percent): No effect.
f. Formaldehyde: No effect.
g. Ethyl Acetate: No effect.
h. Ethyl Ether: No effect.
i. Phenol (85 Percent): Moderate effect.
j. Benzene: No effect.
k. Xylene: No effect.
l. Butyl Alcohol: No effect.
m. Furfural: No effect.
n. Methyl Ethyl Ketone: No effect.
o. Sodium Hydroxide (25 Percent): No effect.
p. Sodium Sulfide (15 Percent): No effect.
q. Ammonium Hydroxide (28 Percent): No effect.
r. Zinc Chloride: No effect.
s. Gentian Violet: No effect.
t. Methyl Red: No effect.

2. Manufacturers and Products:

a. Formica Corporation; Lab Grade 840 Black.
b. Panolam Industries International Incorporated; Pionite Chemguard.
c. Wilsonart International, Div. of Premark International, Inc.; Chemsurf.

3. Colors, Patterns, and Finishes:

a. Selections: As scheduled or as indicated in Design Selections.

G. PVC Laminate: Fire-retardant acrylic/PVC sheet covered in a decorative rigid PVC veneer, 0.040 in (1 mm) thick.

1. Manufacturer and Product: Spectrim; Ven4ma.
2. Colors, Patterns, and Finishes:

a. Selections: As scheduled or as indicated in Design Selections.

H. Simulated Stone Trim:

1. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

a. Manufacturers:

1) Avonite Surfaces.
2) E. I. du Pont de Nemours and Company.
3) Formica Corporation.
4) LG Chemical, Ltd.
5) Meganite Inc.
6) Samsung Chemical USA, Inc.
7) Swan Corporation (The).
8) Transolid, Inc.
9) Wilsonart International.

2. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of polymers, resins, and pigment and complying with ISFA 3-01.

a. Manufacturers:

1) Cambria.
2) Cosentino USA.
3) E. I. du Pont de Nemours and Company.
4) LG Chemical, Ltd.
5) Meganite Inc.
6) Samsung Chemical USA, Inc.
7) Technistone USA, Inc.
8) Transolid, Inc.

3. Cultured Marble: Gel-coated solid fabrication of filled plastic resin complying with CSA B45.5/IAPMO Z124.

a. Manufacturers:

1) Bathroom World Manufacturing Company
2) Cameo Marble
3) Cherry Marble Group.
4) Comar Products, Inc.
5) Craig Baker Marble Co., Inc.
6) Cultured Marble Products
7) Custom Marble Products, Inc.
8) Imperial Marble Corp.
9) Marbleon, Inc.
10) MarCraft, Inc.
11) Mincey Marble Manufacturing, Inc.
12) Princess Marble
13) Roma Marble, Inc.
14) Rynone Manufacturing Corp.
15) Tiffany Marble

4. Colors, Patterns, and Finishes:

a. Selections: As scheduled or as indicated in Design Selections.

I. Glass:

1. Tempered Float Glass for Cabinet Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, 6 mm thick, unless otherwise indicated.
2. Mirror Glass for Cabinet Doors: ASTM C 1503, Mirror Select Glazing, Quality-Q3, 6 mm thick, unless otherwise indicated.
3. Decorative Glass for Cabinet Doors: Provide decorative glass complying with Division 08 Section "Glazing".

4. Tempered Float Glass for Cabinet Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3; with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.

2.5 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated or required, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment types:

1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
2. Interior Type A: Low-hygroscopic formulation.
3. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
4. Kiln-dry materials before and after treatment to levels required for untreated materials.

C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.6 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

1. Refer to Interior Design Documents and Schedules for additional hardware selections.

B. Hinges: Provide number of hinges recommended by hinge manufacturer for size and weight of door.

C. Butt Hinges: 2-3/4 in (69 mm), 5-knuckle steel hinges made from 0.095 in (2.4 mm) thick metal, and as follows:

1. Semi-concealed Hinges for Flush Doors: BHMA A156.9, B01361.
2. Semi-concealed Hinges for Overlay Doors: BHMA A156.9, B01521.

D. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602,

1. Product Standard: Grass; "Tiomos 120 Series", 120 degree swing, self-closing from 10 deg.

   a. Angle Reduction Clip: Provide angle reducing clip at doors adjacent to walls and corners, door swing to be limited to 85 degrees. Finish: Steel with nickel plating. Manufacturer and Product: Grass; Tiomos Angle Reduction Clip, F072135751.

E. Back-Mounted Pulls: BHMA A156.9, B02011.

F. Wire Pulls: Back mounted, solid metal, 4 in (100 mm) long, 5/16 in (8 mm) in diameter.

   1. Product Standard: EPCO-MC-402-4, 4 in (100 mm) center to center of screws, 1-5/16 in (34 mm) projection, 5/16 in (8 mm) diameter. Stainless steel.

G. Catches: Magnetic catches, BHMA A156.9, B03141.

H. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

I. Shelf Rests: BHMA A156.9, B04013; metal.

   1. Product Standard: K & V No. 345, nickel plated.

J. Drawer Slides: BHMA A156.9, B05091.

   1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
   2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 in (150 mm) high and 24 in (600 mm) wide.

      a. Product Standard for 24 in (600 mm) Wide and Less: Full extension; Accuride "7434".
      b. Product Standard for Wider than 24 in (600 mm): Full extension; Accuride "7432".

   3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 in (150 mm) high or 24 in (600 mm) wide.

      a. Product Standard for 42 in (1050 mm) Wide and Less: Full extension with 1 in (25 mm) over travel; Accuride "3640".

   4. Pencil Drawer Slides: Grade 1; for drawers not more than 3 in (75 mm) high and 24 in (600 mm) wide.

      a. Product Standard for 16 in (400 mm) Wide and Less: Low profile, 75 lb (34 kg) load rating (at 2/3 travel), full extension; Accuride "2632".
      b. Keyboard Slides: Grade 1HD-100; for computer keyboard shelves.
      c. Product Standard for Slides Only, 16 in (400 mm) Wide and Less: Adjustable height, 75 lb (34 kg) load rating; Accuride "2109".
      d. Product Standard for Slides and Tray: Fixed tilt, adjustable height; Accuride "Cbergo-Tray 200".
      e. Product Standard for Slides, Tray and Accessories: Adjustable tilt, adjustable height, cable management, palm rest, and mouse pad; Accuride "Cbergo-Tray 300".

   5. Trash Bin Slides: Grade 1HD-200; for trash bins not more than 20 in (500 mm) high and 16 in (400 mm) wide.

K. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

L. Door Locks: BHMA A156.11, E07121.

   1. Product Standard: K & V No. 984, nickel plated.

M. Drawer Locks: BHMA A156.11, E07041.

1. Product Standard: K & V No. 986, nickel plated.

N. Sliding Door Locks:

1. Product Standard: K & V No. 984, nickel plated.

O. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Size: 1-1/4 in (32-mm) or 2 in (50 mm) OD as indicated.
2. Color: Brown, black or white as indicated or selected by Architect.
3. Product Standards: Doug Mockett & Company, Inc "OG or SG Series" or Hafele 429.93.

P. Concealed Pocket Door Slides (Vertical Swing/Slide/Retract):

1. Description: Side mounted flipper door slide assembly suitable for recessed full overlay door, 42 in (1050 mm) high and less, 30 lb (14 kg) load rating, into concealed pocket within cabinet, painted steel slides with all steel ball bearings.
2. Product Standard: Accuride "1321".

Q. Pneumatic Stop for Bench Top: xxx

R. Friction Stay for Bench Top: xxx

S. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630, unless otherwise indicated.

T. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

U. MRI and Related Spaces: Provide non-ferrous cabinet hardware and fasteners comparable in style to other related hardware specified in this Section.

V. Manufacturers:

1. Accuride.
2. Julius Blum, Inc.
3. The Engineered Products Company.
4. Grass America, Inc.
5. Hafele America Company.
6. Hettich America Corporation.
7. Knape & Vogt Manufacturing Company (K & V).
8. Stanley Hardware, Division of the Stanley Works.

W. Cabinet Accessories:

1. Flat-Screen Computer Monitor and Keyboard Mounting System:

a. Product Standard: Hafele; Monitor Suspension System (Flat Screen Monitors).

2. Counter Support Brackets: Unless noted otherwise, provide brackets factory-primed for field painting.

a. Manufacturers and Products:

1) A&M Hardware, Inc.; Work Station Brackets.
2) Rakks/Rangine Corporation; Counter Support Brackets, EH Series.

3. Table Legs:

a. Product Standard: Richelieu; Round Table Legs, Product UC250175, 28 in (711.2 mm) long by 2-1/2 in (62 mm) diameter steel table leg with satin chrome finish.

X. Tackable Wall Surface: Refer to Division 09 Section "Fabric Wrapped Panels".

Y. Tackable Wall Surface:

1. Fabric Wall Coverings: Provide wall coverings with following surface burning characteristics as determined by testing identical products per ASTM E 84/NFPA 255/UL 723. Identify wall coverings with appropriate markings of applicable testing and inspecting organization.

a. Flame Spread: 25 or less; Smoke Developed: 450 or less.
b. Selections: As scheduled or as indicated in Design Selections.

2. Substrate Material: Fiberglass board, ASTM C 612, Class 1 and 2; 6 pcf (96 kgm3) density, compressible, unfaced, with chemically hardened edges.
3. Panel Fabrication: Fabricate panels to sizes and configurations indicated; attach facing materials to core (substrate material) to produce installed panels with visible surfaces fully covered and free from waves in fabric weave, wrinkles, sags, blisters, seams, adhesive, or other foreign matter.

2.7 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Rough Carriages for Stairs: Select Structural grade, kiln dried to 15 percent maximum moisture content.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

D. Handrail Brackets: Cast or Extruded with wall flange drilled and tapped for concealed hanger bolt and with support arm for screwing to underside of rail. Sized to provide 1-1/2 in (38 mm) clearance between handrail and wall.

E. Adhesives:

1. General: As recommended by woodwork fabricator to suit application.
2. Adhesive for Bonding Plastic Laminate Faces and Edges: PVA as recommended by woodwork fabricator to suit application.

F. Hanging Clips: Provide manufacturer standard nonferrous-metal or hot-dip galvanized zee hanging clips.

2.8 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium Grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fire Retardant Treated Wood: Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 in (19 mm) Thick or Less: 1/16 in (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 in (19 mm) Thick: 1/8 in (3 mm).

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Countertops: Seal edges of openings in countertops.

G. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual". For glass in wood frames, secure glass with removable stops.

2.9 INTERIOR STANDING AND RUNNING TRIM

A. Grade for Transparent Finish: Premium.

B. Grade for Opaque Finish: Premium.

C. Grade for Opaque Finish: Custom.

D. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

E. For trim items wider than available lumber, use veneered construction. Do not glue for width.

F. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

G. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.10 INTERIOR FRAMES AND JAMBS

A. Grade for Transparent Finish: Premium.

B. Grade for Opaque Finish: Premium.

C. For frames or jambs wider than available lumber, use veneered construction. Do not glue for width.

D. Fire-Rated Interior Frames and Jambs: Products fabricated from fire-retardant particleboard or fire-retardant medium-density fiberboard with veneered, exposed surfaces and listed and

labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Fire Rating: 20 minutes.

2.11 STAIR WORK AND RAILS

A. Grade for Transparent Finish: Premium.

B. Grade for Opaque Finish: Premium.

C. Cut carriages to accurately fit treads and risers. Glue treads to risers, and glue and nail treads and risers to carriages.

1. House wall and face stringers and glue and wedge treads and risers.
2. Fabricate stairs with treads and risers no more than 1/8 in (3 mm) from indicated position and no more than 1/16 in (1.5 mm) out of position for adjacent treads and risers.

2.12 FLUSH WOOD PANELING

A. Grade for Transparent Finish: Premium.

B. Grade for Opaque Finish: Premium.

C. Lumber Trim and Edges: If not indicated, trim and edges shall be solid wood lumber compatible with grain and color of veneered panels.

D. Matching Requirements: As scheduled or as indicated in Design Selections.

E. Fire-Retardant-Treated Paneling: Provide panels consisting of wood veneer and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have flame-spread index of 75 or less and smoke-developed index of 450 or less per ASTM E 84.

2.13 FLUSH PLASTIC-LAMINATE PANELING

A. Grade: Premium.

B. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Faces: Grade HGS, 1.0 mm thick.
2. Edges: Same as faces.

C. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKH, 1.0 mm thick.

D. Fire-Retardant-Treated Paneling: Provide panels consisting of fire-retardant plastic laminate and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have a flame-spread rating of 75 or less and a smoke-developed rating of 450 or less per ASTM E 84.

2.14 STILE AND RAIL WOOD PANELING FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Stiles and Rails: If not indicated, at fabricator's option, stiles and rails may be either lumber or veneered construction with edges banded or with lumber moldings, as indicated, to conceal core and veneer joints.

C. Panels: Flat or raised panels with veneered faces and solid lumber rims as indicated.

D. Insert Panels: Blueprint matched in a horizontal sequence for adjacent panels and doors, with continuous vertical matching between adjacent panels. Book and balance or Book, balance, and center match face-veneer leaves within each panel as indicated.

1. Flitch Requirements: As scheduled or as indicated in Design Selections for requirements concerning flitches reserved by Architect.

E. Shop-assemble stile and rail paneling into largest units practical for delivery and installation. Provide shop-prepared detachable joints for necessary field connections. Sand and pull joints tight in shop so field joints will comply with joint tolerances for specified grade. Unless otherwise indicated, provide continuous mortise-and-tenon joints between panel units and provide removable temporary protection for joints during handling and delivery.

1. Outside Corner of Stile and Rail Paneling: Shop-prepare using lock-mitered or mitered-and-splined construction. Assemble, sand, and glue in shop, if site conditions permit.

F. Fire-Retardant-Treated Paneling: Provide panels consisting of fire-retardant lumber and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have a flame-spread rating of 75 or less and a smoke-developed rating of 450 or less per ASTM E 84.

2.15 STILE AND RAIL WOOD PANELING FOR OPAQUE FINISH

A. Grade: Premium.

B. Provide fire-retardant treatment of stile and rail paneling as indicated below. For components of paneling fabricated from solid lumber, mill pieces before treatment.

1. For stiles and rails, use fire-retardant-treated lumber or fire-retardant medium-density fiberboard.
2. For insert panels, use fire-retardant medium-density fiberboard or fire-retardant particleboard with closed-grain hardwood veneer on face and back or medium density overlay.

C. Shop-assemble stile and rail paneling into largest units practical for delivery and installation. Provide shop-prepared detachable joints for necessary field connections. Sand and pull joints tight in shop so field joints will comply with joint tolerances for specified grade. Unless otherwise indicated, provide continuous mortise-and-tenon joints between panel units and provide removable temporary protection for joints during handling and delivery.

1. Outside Corner of Stile and Rail Paneling: Shop-prepare using lock-mitered or mitered-and-splined construction. Assemble, sand, and glue in shop, if site conditions permit.

2.16 INTERIOR ORNAMENTAL WORK

A. Interior ornamental work includes but is not limited to the following:

1. Balustrades.
2. Columns.
3. Grilles.
4. Mantels.
5. Pediment heads.
6. Pilasters.

B. Grade for Transparent Finish: Premium.

C. Grade for Opaque Finish: Premium.

2.17 WOOD CABINETS FOR TRANSPARENT FINISH

A. Grade: Premium.

B. AWI Type of Cabinet Construction: Flush overlay unless indicated otherwise.

C. Lumber Trim and Edges: If not indicated, trim and edges shall be solid wood lumber compatible with grain and color of veneered panels.

D. Grain Direction: Vertically for drawer fronts, doors, and fixed panels, unless indicated otherwise.

E. Matching Requirements: As scheduled or as indicated in Design Selections.

F. Semi-exposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
2. Lumber Trim and Edges: Solid wood of same species and cut indicated for exposed surfaces.
3. Drawer Sides, Backs and Sub-Fronts: 1/2 in (12 mm) minimum thickness, as indicated.
   a. Solid-hardwood lumber, same species indicated for exposed surfaces.
4. Drawer Bottoms: 1/4 in (6 mm) minimum thickness, as indicated.
   a. Hardwood plywood with veneer core.
5. Drawer Box Construction: One of the following:
   a. Glued multiple dovetail.
   b. Glued French dovetail.
   c. Glued and doweled.
6. Interior Drawer Box Finish, as indicated:
   a. Clear catalyzed polyurethane.

G. Body Members (Ends, Divisions, Bottoms and Sub-Tops): Medium-density fiberboard, 3/4 in (19 mm) minimum thickness.

H. Face Frames, Rails, Kicks and Bases: Solid-hardwood lumber or hardwood plywood, 3/4 in (19 mm) thick minimum thickness. Do not use hardwood plywood if hinge screws enter edge of rail only.

I. Shelves: Hardwood plywood with veneer core with the following thickness:

1. For Spans Up To 32 in (800 mm): 3/4 in (19 mm).
2. For Spans Up To 42 in (1050 mm): 1 in (25 mm).

J. Drawer Fronts: Medium density fiberboard, 3/4 in (19 mm) thick minimum thickness.

K. Doors:

1. Hinged Flush Type: Medium density fiberboard with minimum thickness of 3/4 in (19 mm).
   a. Maximum cabinet door size: 24 in (600 mm) width and 84 in (2100 mm) height.
   b. Maximum cabinet door size: 20 in (500 mm) width and 84 in (2100 mm) height.
   c. For Doors Larger Than Sizes Above: 1-3/8 in (35 mm) or 1-3/4 in (45 mm) doors; refer to Division 8 Section Flush Wood Doors.

d. If hinge screws enter only edge of door, provide 3/4 in (19 mm) lumber edges glued to core prior to laminating.

2. Sliding Flush Type: As required by referenced quality standard for grade specified.
3. Stile and Rail Type: As required by referenced quality standard for grade specified.

2.18 WOOD CABINETS FOR OPAQUE FINISH

A. Grade: Premium.

B. AWI Type of Cabinet Construction: Flush overlay unless indicated otherwise.

C. Lumber Trim and Edges: If not indicated, trim and edges shall be solid wood lumber compatible with grain and color of veneered panels.

D. Panel Product for Exposed Surfaces: Hardwood plywood with veneer core.

E. Semi-exposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Match materials indicated for exposed surfaces.
2. Lumber Trim and Edges: Solid wood compatible with grain and color of veneered panels.
3. Drawer Sides, Backs and Sub-Fronts: 1/2 in (12 mm) minimum thickness, as indicated.

a. Solid-hardwood lumber.

4. Drawer Bottoms: 1/4 in (6 mm) minimum thickness, as indicated.

a. Hardwood plywood with veneer core.

5. Drawer Box Construction: One of the following:

a. Glued multiple dovetail.
b. Glued French dovetail.
c. Glued and doweled.

6. Interior Drawer Box Finish, as indicated:

a. Clear catalyzed polyurethane.

F. Body Members (Ends, Divisions, Bottoms and Sub-Tops): Medium-density fiberboard, 3/4 in (19 mm) minimum thickness.

G. Face Frames, Rails, Kicks and Bases: Solid-hardwood lumber or hardwood plywood, 3/4 in (19 mm) thick minimum thickness. Do not use hardwood plywood if hinge screws enter edge of rail only.

H. Shelves: Hardwood plywood with veneer core with the following thickness:

1. For Spans Up To 32 in (800 mm): 3/4 in (19 mm).
2. For Spans Up To 42 in (1050 mm): 1 in (25 mm).

I. Drawer Fronts: Medium density fiberboard, 3/4 in (19 mm) thick minimum thickness.

J. Doors:

1. Hinged Flush Type: Medium density fiberboard with minimum thickness of 3/4 in (19 mm).

a. Maximum cabinet door size: 24 in (600 mm) width and 84 in (2100 mm) height.
b. Maximum cabinet door size: 20 in (500 mm) width and 84 in (2100 mm) height.
c. For Doors Larger than Sizes Above: 1-3/8 in (35 mm) or 1-3/4 in (45 mm) doors; refer to Division 8 Section Flush Wood Doors.

d. If hinge screws enter only edge of door, provide 3/4 in (19 mm) lumber edges glued to core prior to laminating.

2. Sliding Flush Type: As required by referenced quality standard for grade specified.
3. Stile and Rail Type: As required by referenced quality standard for grade specified.

2.19 PLASTIC-LAMINATE CABINETS

A. Grade: Premium.

B. AWI Type of Cabinet Construction: Flush overlay unless indicated otherwise.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGP, .038 in (1 mm) thick.
2. Postformed Surfaces: Grade HGP, .038 in (1 mm) thick.
3. Doors and Vertical Surfaces: Grade VGS, .028 in (0.7 mm) thick.
4. Edges: PVC Edge Banding, 0.12 in (3 mm) thick, matching laminate in color, pattern, and finish.
5. Edges: Grade HGS, .048 in (1.2 mm) thick.

D. Semi-exposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade CLS, .020 in (0.5 mm) thick.
2. Edges: PVC Edge Banding, .038 in (1 mm) thick, matching laminate in color, pattern, and finish.
3. Drawer Sides, Backs and Sub-Fronts: 1/2 in (12 mm) minimum thickness, as indicated.

a. Solid-hardwood lumber.

4. Drawer Bottoms: 1/4 in (6 mm) minimum thickness, as indicated.

a. Hardwood plywood with veneer core.
b. High pressure decorative laminate with veneer core plywood.

5. Drawer Box Construction: One of the following:

a. Glued multiple dovetail.
b. Glued French dovetail.
c. Glued and doweled.

6. Interior Drawer Box Finish, as indicated:

a. Clear catalyzed polyurethane.
b. High-pressure decorative laminate, Grade CLS, .020 in (0.5 mm) thick.

E. Body Members (Ends, Divisions, Bottoms and Sub-Tops): Medium-density fiberboard, 3/4 in (19 mm) minimum thickness.

F. Face Frames, Rails, Kicks and Bases: Solid-hardwood lumber or hardwood plywood, 3/4 in (19 mm) thick minimum thickness.

G. Face Frames and Rails: Solid-hardwood lumber or hardwood plywood, 3/4 in (19 mm) thick minimum thickness.

H. Kicks and Bases: Solid-hardwood lumber, 1 1/2 (38 mm) thick minimum thickness.

I. Shelves: Hardwood plywood with veneer core with the following thickness:

1. For Spans Up To 32 in (800 mm): 3/4 in (19 mm).

2. For Spans Up To 42 in (1050 mm): 1 in (25 mm).

J. Drawer Fronts: Medium density fiberboard, 3/4 in (19 mm) thick minimum thickness.

K. Doors:

1. Hinged Flush Type: Medium density fiberboard with minimum thickness of 3/4 in (19 mm).

a. Maximum cabinet door size: 24 in (600 mm) width and 84 in (2100 mm) height.
b. Maximum cabinet door size: 20 in (500 mm) width and 84 in (2100 mm) height.
c. For Doors Larger than Sizes Above: 1-3/8 in (35 mm) or 1-3/4 in (45 mm) doors; refer to Division 08 Section "Flush Wood Doors".
d. If hinge screws enter only edge of door, provide 3/4 in (19 mm) lumber edges glued to core prior to laminating.

2. Sliding Flush Type: As required by referenced quality standard for grade specified.
3. Stile and Rail Type: As required by referenced quality standard for grade specified.

L. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL, .020 in (0.5 mm) thick.

M. Concealed Edges of Base Cabinet Panels: Including but not limited to floors, vertical edges, splashes and countertops; Clear Catalyzed Polyurethane.

2.20 WOOD COUNTERTOPS

A. Grade: Premium.

B. Type of Top: Panel product for transparent finish (wood veneer laminated over core) as follows:

1. Edge Treatment: Solid wood matching face for species and cut, 3/4 in (19 mm) thick minimum thickness, as indicated.
2. Core Material: Medium-density fiberboard, moisture resistant, binder containing no added urea formaldehyde, 3/4 in (19 mm) thick minimum thickness.

2.21 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Premium.

B. High-Pressure Decorative Laminate Grade:

1. High-Pressure Decorative Laminate Grade for Flat Countertops: Grade HGS, .048 in (1.2 mm) thick.
2. High-Pressure Decorative Laminate Grade for Post-formed Countertops: Grade HGP, .038 in (1.0 mm) thick.

C. Grain Direction for Wood Grain Laminates: Parallel to cabinet fronts.

D. Edge Treatment: PVC edge banding, 0.12 in (3 mm) thick, matching laminate in color, pattern, and finish, as indicated.

E. Edge Treatment: Grade HGS or HGP, .048 in (1.2 mm) thick.

F. Core Material for Countertops: Medium-density fiberboard, moisture resistant, binder containing no added urea formaldehyde, 3/4 in (19 mm) thick minimum thickness.

G. Core Material for Side and Back Splashes: Medium-density fiberboard, moisture resistant, binder containing no added urea formaldehyde, 1/2 in (12 mm) thick minimum thickness.

H. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, .020 in (0.5 mm) thick, on underside of countertop substrate.

I. Concealed Backs and Edges at Side and Back Splashes: High-pressure decorative laminate, Grade BKL, .020 in (0.5 mm) thick.

2.22 SOLID SURFACING COUNTERTOPS

A. Refer to Division 12 Section "Simulated Stone Countertops".

2.23 QUARTZ AGGLOMERATE COUNTERTOPS

A. Refer to Division 12 Section "Simulated Stone Countertops".

2.24 CULTURED MARBLE COUNTERTOPS

A. Refer to Division 12 Section "Simulated Stone Countertops".

2.25 STAINLESS STEEL COUNTERTOPS AND SHELVING

A. Stainless-Steel: 0.0625 in (1.5 mm) thick, stainless-steel sheet, ASTM A 666, Type 304, with No. 4 satin finish.

B. Countertops: Weld shop-made joints, and grind and polish surfaces to produce uniform, directional, textured, polished finish indicated, free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1. Sound-deaden entire undersurface with heavy-build mastic coating.
2. Extend top down to provide a 1 in (25 mm) thickness and a 1/2 in (12 mm) return flange under frame.
3. Form backsplash coved to and integral with top surface.
4. Provide raised marine edge around perimeter of tops containing sinks; pitch two ways to sink to provide drainage without channeling or grooving.

C. Integral Sinks: Where stainless-steel sinks occur in stainless-steel tops, factory weld into one integral unit, grind welds smooth, and polish, passivate, and rinse.

1. Fabricate stainless-steel sinks with corners rounded and coved to at least a 5/8 in (15 mm) radius. Slope sink-bottoms to outlet. Provide double-wall construction for sink partitions with top edge rounded to at least a 1/2-in (12 mm) diameter.

D. Fixed Shelving: Fold front and side edges down to provide 1-inch (25 mm) thickness. Fold rear edge up 1-1/2 inch (38 mm) to form a mounting flange. Weld corners. Construct integral wall mounting brackets of 0.0781 inch (2 mm) stainless steel with 1-1/2 inch (38 mm) flange at wall and completely welded to underside of shelf.

E. Adjustable Shelving: Fold front, side, and rear edges down to provide a 1-inch (25 mm) thickness and mounting flange. Weld corners. Mount on adjustable stainless steel brackets supported by slotted wall standards.

2.26 CLOSET AND UTILITY SHELVING

A. Grade: Custom.

B. Shelf Material: 3/4 in (19 mm) solid lumber or veneer-faced panel product with solid-lumber edge.

C. Cleats: 3/4 in (19 mm) solid lumber.

2.27 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. Shop Priming: Shop apply the prime coat including backpriming, if any, for items specified to be field finished. Refer to Division 09 Painting Sections for material and application requirements.

D. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate.

E. Finish:

1. Selections: As scheduled or as indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive interior architectural woodwork and associated work to which interior architectural woodwork will be applied for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Quality standards. (The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.)
2. Respective manufacturer/fabricator’s written installation instructions.
3. Accepted submittals.
4. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.4 INSTALLATION

A. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication, to extent that it was not completed in the shop.

B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 in per 96 in (3 mm per 2400 mm).

C. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 in (900 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install wall railings on indicated metal brackets securely fastened to wall framing.
3. Install standing and running trim with no more variation from a straight line than 1/8 in per 96 in (3 mm per 2400 mm).

G. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless covered by trim or otherwise indicated.

1. Install flush paneling with no more than 1/16 in per 96 in (1.5 mm per 2400 mm) vertical cup or bow and 1/8 in per 96 in (3 mm per 2400 mm) horizontal variation from a true plane.
2. Flush Paneling with Revealed Joints: Install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 in (0.75 mm).

H. Stairs: Securely anchor carriages to supporting substrates. Install stairs with treads and risers no more than 1/8 in (3 mm) from indicated position.

I. Railings:

1. General: Install rails with no more than 1/8 in per 96 in (3 mm per 2400 mm) variation from a straight line.
2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
3. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.

a. Space rail brackets as required but not more than 5 ft (1525 mm) on center.

J. Cabinets, General: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 in per 96 in (3 mm per 2400 mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.

K. Base and Wall Cabinets: Set base cabinets straight, level, and plumb. Adjust subtops within 1/16 in (1.5 mm) of a single plane. Fasten base cabinets to partition framing, or reinforcements in partitions with fasteners spaced 24 in (600 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.

1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24 in (600 mm) on center. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.
2. Wall Cabinets: Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 in (400 mm) on center with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish or toggle bolts through metal backing or metal framing behind wall finish.

L. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Where possible make field jointing in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
2. Plastic Laminate Countertops: Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 in (150 mm) of front and back edges and at intervals not exceeding 24 in (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
3. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.
4. Simulated Stone Countertops: Refer to Division 12 Section "Simulated Stone Countertops".
5. Install countertops with no more than 1/8 in per 96 in (3 mm per 2400 mm) sag, bow, or other variation from a straight line.
6. Secure backsplashes to tops with concealed metal brackets at 16 in (400 mm) on center and to walls with adhesive.
7. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants".

M. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.5 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.6 WOOD TYPES SCHEDULE

A. Wood Species and Cut for Transparent Finish:

1. WD01:

a. Species and Cut:
b. Stain:
c. Locations: As indicated on drawings.

3.7 LAMINATE TYPES SCHEDULE

A. High-Pressure Decorative Laminates (HPDL) Basis of Design (Product Standard):

1. PL01:

a. Manufacturer:
b. Texture:
c. Color:
d. Locations: As indicated on drawings.

B. Chemical-Resistant, High-Pressure Decorative Laminates (HPDL) Basis of Design (Product Standard):

1. CRPL01:

a. Manufacturer:
b. Texture:
c. Color:
d. Locations: As indicated on drawings.

C. PVC Laminate Basis of Design (Product Standard):

1. PL11:

a. Manufacturer:
b. Texture:
c. Color:
d. Locations: As indicated on drawings.

3.8 SIMULATED STONE TRIM SCHEDULE

A. Simultated Stone Fabrications (Product Standard):

1. SSF01: Solid Surfacing

a. Type: [Solid Surfacting][Quartz Agglomerate][Cultured Marble]
b. Manufacturer:
c. Product:
d. Locations: As indicated on drawings.

3.9 TACKABLE WALL SURFACE TYPES SCHEDULE

A. Fabric Wall Surface Basis of Design (Product Standard):

1. FP01:

a. Manufacturer:
b. Product:
c. Selection:
d. Locations: As indicated on drawings.

3.10 FLUSH WOOD PANELING MATCHING SCHEDULE

A. Matching Requirements:

1. Matching of Adjacent Veneer Leaves:

a. Book match.

b. Slip match.
c. As indicated on drawings.

2. Matching within Panel Face:

a. Running match.
b. Balance match.
c. Center-balance match.
d. As indicated on drawings.

3. Panel-Matching Method: Match panels within each separate area by the following method:

a. Blueprint-matched panels and components.
b. Flitch Requirements:

4. Vertical Panel Matching Method: For panels arranged two or more panels high, match as follows:

a. Continuous end match; veneer leaves of upper panels are continuations of veneer leaves of lower panels.
b. Architectural end book match; veneer leaves are individually book matched from lower panels to upper panels.
c. Architectural end slip match; veneer leaves are individually slip matched from lower panels to upper panels.
d. Panel end book match; panels are book matched from lower panels to upper panels.
e. Panel end slip match; panels are slip matched from lower panels to upper panels.

3.11 STILE AND RAIL WOOD PANELING FLITCH REQUIREMENTS SCHEDULE

A. Flitch Requirements:

3.12 WOOD CABINETS MATCHING SCHEDULE

A. Matching Requirements:

1. Matching of Veneer Leaves:

a. Book match.
b. Slip match.
c. Random match.
d. As indicated on drawings.

2. Matching Within Panel Face:

a. Running match.
b. Balance match.
c. Center-balance match.
d. As indicated on drawings.

3. Veneer Matching within Room: Blueprint matching; Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

3.13 SHOP FINISHING SCHEDULE

A. Transparent Finish:

1. Finish System - 5: Conversion varnish.

2. Staining: Match Architect's sample.
3. Staining:
4. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
5. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.

    a. Apply wash-coat sealer after staining and before filling.

6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

B. Opaque Finish:

1. Finish System - 5: Conversion varnish.
2. Color: Match Architect's sample.
3. Sheen: Semi-gloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 066100
SIMULATED STONE FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The following simulated stone fabrications along with supplementary items necessary for installation:

1. Solid surfacing fabrications.
2. Quartz agglomerate fabrications.
3. Cultured marble fabrications.
4. Simulated stone shower components.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Show materials, finishes, edge profiles, methods of joining, locations, and details of joints.
2. Show locations and sizes of cutouts and holes for plumbing fixtures, accessories and other items installed in fabrications.
3. Show direction of directional pattern, if any.

C. Samples for Verification Purposes:

1. Panel Material: 6 in (150 mm) square, showing color and pattern selected. Trim piece samples to be 6 in (150 mm) long.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For simulated stone fabrications to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of sources for products.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.

2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.

C. Fire-Test-Response Characteristics: Provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to adjacent construction, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install fabrications until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer’s standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Solid Surfacing:

a. Avonite Surfaces
b. E. I. du Pont de Nemours and Company
c. Formica Corporation
d. Inpro Architectural Products.
e. LG Chemical, Ltd.
f. Meganite Inc.
g. Samsung Chemical USA, Inc.
h. Swan Corporation (The)
i. Transolid, Inc.
j. Watermark Fabrication.
k. Wilsonart International

2. Quartz Agglomerate:

a. Cambria
b. Cosentino USA
c. E. I. du Pont de Nemours and Company

d. LG Chemical, Ltd.
e. Meganite Inc.
f. Samsung Chemical USA, Inc.
g. Technistone USA, Inc.
h. Transolid, Inc.
i. Watermark Fabrication.

3. Cultured Marble:

a. Bathroom World Manufacturing Company
b. Cameo Marble
c. Cherry Marble Group.
d. Comar Products, Inc.
e. Craig Baker Marble Co., Inc.
f. Cultured Marble Products
g. Custom Marble Products, Inc.
h. Imperial Marble Corp.
i. Marbleon, Inc.
j. MarCraft, Inc.
k. Mincey Marble Manufacturing, Inc.
l. Princess Marble
m. Roma Marble, Inc.
n. Rynone Manufacturing Corp.
o. Tiffany Marble

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 SOLID SURFACE MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Colors and Patterns: As scheduled or indicated in Design Selections.

B. Panel Thickness: Minimum 1/4 in (6 mm) or as indicated on drawings or as recommended by simulated stone manufacturer.

C. Trim Piece Thickness: As recommended by simulated stone manufacturer/fabricator.

2.4 QUARTZ AGGLOMERATE MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of polymers, resins, and pigment and complying with ISFA 3-01.

1. Colors and Patterns: As scheduled or indicated in Design Selections.

B. Panel Thickness: Minimum 1/4 in (6 mm) or as indicated on drawings or as recommended by simulated stone manufacturer.

C. Trim Piece Thickness: As recommended by simulated stone manufacturer/fabricator.

2.5 CULTURED MARBLE MATERIALS

A. Cultured Marble: Gel-coated solid fabrication of filled plastic resin complying with CSA B45.5/IAPMO Z124.

1. Colors and Patterns: As scheduled or indicated in Design Selections.

B. Panel Thickness: Minimum 1/4 in (6 mm) or as indicated on drawings or as recommended by simulated stone manufacturer.

C. Trim Piece Thickness: As recommended by simulated stone manufacturer/fabricator.

2.6 SOLID SURFACE SHOWER COMPONENTS

A. Shower Base: Manufacturer's standard shower base including built-in trench drain assembly installed in receptor and water evacuation channels on a slip-resistant surface.

1. Manufacturers:

a. Avonite Surfaces by Aristech Surfaces LLC.
b. Best Bath Systems.
c. Inpro Architectural Products.

2. Basis of Design Manufacturer and Product: Inpro Architectural Products; BioPrism Series.

a. Configuration: As indicated on Drawings.

3. Size: As indicated on drawings; but with shower stalls no less than 36-by-36 in (915-by-915 mm) clear and transfer showers no less than 30-by-60 in (760-by-1525 mm) clear.
4. Color and Patterns: Manufacturer standard white as accepted by Architect.

B. Shower Compartment: Manufacturer's standard simulated stone shower system including shower base, wall panels, recessed soap/shampoo holder, and corner trim for field assembly.

2.7 CULTURED MARBLE SHOWER COMPONENTS

A. Shower Base: Manufacturer's standard shower base including built-in trench drain assembly installed in receptor.

1. Manufacturers:

a. Mincey Marble Manufacturing, Inc.

2. Basis of Design Manufacturer and Product: Mincey Marble Manufacturing, Inc.; Trench Drain Shower Pans.

a. Configuration: As indicated on Drawings.

3. Size: As indicated on drawings.
4. Color and Patterns: As scheduled or as indicated in Design Selections.

B. Shower Compartment: Manufacturer's standard simulated stone shower system including shower base, wall panels, and corner trim for field assembly.

2.8 FABRICATION

A. Comply with simulated stone manufacturer’s written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate items without joints unless otherwise indicated.

B. Cutouts and Holes:

1. Make cutouts using template or pattern. Form cutouts to smooth, even curves.
2. Drill fabrications for fittings and similar items.

C. Accurately cut holes and drill panels in shop for penetrations and fittings indicated on Drawings. Obtain field measurements prior to fabrication and maintain minimum clearance at walls.

2.9 INSTALLATION MATERIALS

A. Adhesives: Product recommended by simulated stone manufacturer.

B. Accessories: Provide joint seam adhesives and other items required for a complete installation as recommended in writing by simulated stone manufacturer.

C. Sealant: Mildew resistant silicone sealant as specified in Division 07 Section Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 in per 48 in (1.5 mm per 1200 mm).

B. Variation from Level: Do not exceed 1/8 in per 96 in (3 mm per 2400 mm), 1/4 in (6 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/4 of nominal joint width.

D. Variation in Plane at Joints (Lipping): Do not exceed 1/64 in (0.4 mm) difference between planes of adjacent units.

E. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64 in (0.4 mm) difference between edges of adjacent units, where edge line continues across joint.

3.5 INSTALLATION OF SIMULATED STONE FABRICATIONS

A. Install fabrications according to material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

B. Bond joints with adhesive and draw tight as fabrications are set. Mask surfaces of fabrications adjacent to joints to prevent adhesive smears.

1. Clamp units to temporary bracing, supports, or each other to ensure that fabrications are properly aligned and joints are of specified width.

C. Complete cutouts not finished in shop. Mask areas of fabrications adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

D. Apply sealant and compress to form bond with simulated stone material and adjacent surfaces and tool sealant surfaces to clean, straight lines.

1. Comply with Division 07 Section Joint Sealants

3.6 CLEANING

A. Promptly clean simulated stone as work progresses. Do not leave adhesive or sealant to dry on simulated stone faces.

B. Clean and protect installed fabrications in accordance with manufacturer's instructions.

3.7 FINISH SCHEDULE

A. Color: As selected by Architect from manufacturer's standard colors.

B. Color:

C. SSF01:

1. Type:

a. Solid Surfacing.
b. Quartz Agglomerate.
c. Cultured Marble.

2. Manufacturer:
3. Color:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 066400
PLASTIC (FRP) PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

B. Related Sections:

1. Division 10 Section "Wall and Corner Guards" for adhesive-applied impact-resistant wall protection systems labeled as Plastic Wall Protection.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.
3. Testing Agency: Acceptable to authorities having jurisdiction.

1.4 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

B. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit

as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into Work include but are not limited to those listed.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PLASTIC SHEET PANELING

A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.

1. Manufacturers:

a. Crane Composites (Kemlite)
b. Marlite.
c. Nudo Products, Inc.

2. Nominal Thickness: Not less than 0.09 in (2.3 mm).
3. Surface Finish: Molded pebble texture.
4. Color: As scheduled or as indicated in Design Selections.

2.4 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer.

E. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.

2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. At existing partitions-to-remain:

1. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
2. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 in (300 mm) wide.

1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.4 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive.

D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.5 FINISH SCHEDULE

A. Color: As selected by Architect from manufacturer's full range.

B. Color:

C. FRP01:

1. Color:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 066413
TRANSLUCENT RESIN PANEL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes translucent resin panel (aka "3Form") fabrications and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: 8 by 10 in (200 by 250 mm), for each type, color, pattern, and surface finish of translucent resin panel products.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 3 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 3 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

C. Fire-Test-Response Characteristics: Provide panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

D. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.

3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.4 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. 3Form, Inc.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 FABRICATION

A. Comply with manufacturer’s written recommendations for fabrication.

B. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.

1. Sawing: Select equipment and blades suitable for type of cut required.
2. Drilling: Drills specifically designed for use with plastic products.
3. Milling: Climb cut where possible.
4. Routing.
5. Tapping.

C. Forming: Form products to shapes indicated using the appropriate method listed below. Comply with manufacturer's written instructions.

1. Cold Bending.
2. Hot Bending.
3. Thermoforming: Acceptable only on uncoated material.
4. Drape Forming.
5. Matched Mold Forming.
6. Mechanical Forming.

D. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaner: Type recommended by manufacturer.

C. Fasteners: Use screws designed specifically for plastics. Self-threading screws are acceptable for permanent installations. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures.

D. Bonding Cements: Manufacturer's recommended bonding adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Approved submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Manufacturer's shop to fabricate items to the greatest degree possible.

B. Utilize fasteners, adhesives and bonding agents recommended by manufacturer for type of installation indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.

C. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

D. Form field joints using manufacturer's recommended procedures. Locate seams in panels so that they are not directly in line with seams in substrates.

3.5 CLEANING AND PROTECTION

A. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to Architect's satisfaction.

3.6 TRANSLUCENT RESIN PANEL SCHEDULE

A. TRP01:

1. Manufacturer:
2. Style:
3. Color:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 071326
SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sheet waterproofing systems and supplementary items necessary for installation at the following applications

1. Vertical post-applied modified bituminous sheet waterproofing at foundation walls.
2. Horizontal post-applied modified bituminous sheet waterproofing at above grade split slabs.
3. Horizontal post-applied modified bituminous sheet waterproofing at earth covered horizontal decks.
4. Vertical pre-applied (blindside) sheet waterproofing at retention system walls.
5. Vertical pre-applied (blindside) sheet waterproofing at retention system walls with shotcrete foundation walls.
6. Horizontal pre-applied (blindside) sheet waterproofing below slabs-on-grade over mud slab or prepared subgrade.

B. Related Requirements:

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
2. Foundation Drainage System: Refer to Division 33 Section Foundation Drainage System.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include construction details, material descriptions, tested physical and performance properties, and installation instructions for waterproofing.

a. Include details for Project specific conditions.

2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show locations and extent of waterproofing and details of installation, including plans, elevations, sections, details of components and attachments to other work.

1. Include details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
2. Include manufacturer's written approval of shop drawings prior to submission.

C. Samples: For each exposed product and for each color and texture specified, including the following products:

1. Waterproofing and Flashing: 12 in (300 mm) square.
2. Protection Course: 12 in (300 mm) square.
3. Molded-Sheet Drainage Panels: 12 in (300 mm) square.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1. Provide written confirmation by the manufacturer that Geotechnical Report has been reviewed and that manufacturer takes no exception to the design of the below grade waterproofing system.
2. Submit the following certifications prior to installation:
   a. Concrete Substrate: Waterproofing manufacturer shall certify that concrete substrate condition and corrections, if necessary, comply with manufacturer installation guidelines.

B. Preconstruction Test Reports: For water samples taken at Project site along with recommendations resulting from these tests

C. Field Quality-Control Reports: Written report of testing and inspection required by "Field Quality Control".

D. Warranties:
   1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
   1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
   2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
   3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Pre-Construction Subsoil Water Testing: Engage a qualified testing agency to perform preconstruction testing on ground water. Comply with waterproofing manufacturer's written instructions for testing.
   1. General Requirements: Obtain water samples from Project site at approximate locations where waterproofing will be installed and test for acids, alkalis, brine, or other contaminants that may inhibit performance of waterproofing materials.
   2. Reports: Interpret test results and certify reports indicating compliance with requirements for use of waterproofing materials and corrective measures necessary.

1.5 MOCKUPS

A. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
   1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, sealing at penetrations, crack and joint treatments, inside and outside corner treatments, and protection.
      a. Size: 100 sq. ft. (9.3 sq. m) in area.
      b. Description: Each type of wall and deck installation.
         1) Include Project specific conditions, transitions, expansion joints.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

   a. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.

3. Accepted mock-ups may become part of completed Work if undisturbed at time of Substantial Completion.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

   a. Architect.
   b. Contractor, including superintendent.
   c. Installer, including project manager and supervisor.
   d. If requested, Manufacturer's qualified technical representative.
   e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review inspection and testing requirements.
   e. Review environmental conditions and procedures for coping with unfavorable conditions.
   f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate the Work of this Section with adjacent concrete foundation work, including fill.

C. Coordinate formwork and form bracing requirements for blindside sheet waterproofing. Coordinate restrictions on use of form ties and other components as necessary to eliminate or minimize penetrations through blindside sheet waterproofing.

1.10 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written Total System Performance Warranty signed by an authorized representative using manufacturer's standard form, without monetary limitation (NDL), agreeing to repair or replace components of waterproofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.

a. Warranty includes waterproofing, flashings, counter-flashings, insulation, below grade expansion joints and other components of waterproofing system necessary to provide a complete installation.

B. Installer’s Warranty: Included under Manufacturer Total System Performance Warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Post-Applied Sheet Waterproofing:

a. Basis of Design: GCP Applied Technologies; Bituthene 3000 or 4000.

2. Pre-Applied Sheet Waterproofing for Vertical Applications:

a. Basis of Design: GCP Applied Technologies; Preprufe 160R Plus.

3. Pre-Applied Sheet Waterproofing for Shotcrete Applications, Non-Hydrostatic Drained Conditions:

a. Basis of Design: GCP Applied Technologies; GCP Applied Technologies; Preprufe 275/275LT.

4. Pre-Applied Sheet Waterproofing for Grout-Injected Shotcrete Applications, Hydrostatic Non-Drained Conditions:
   a. Basis of Design: GCP Applied Technologies; Preprufe SCS Waterproofing.
5. Pre-Applied Sheet Waterproofing for Horizontal Applications:
   a. Basis of Design: GCP Applied Technologies; Preprufe 300R Plus.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
   1. Provide waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.
   2. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Provide sheet waterproofing systems that prevent the passage of liquid water. Waterproofing shall accommodate normal substrate movement and seal expansion and control joints, construction material transitions, opening transitions, penetrations, and perimeter conditions without deterioration.
   2.

B. Material Compatibility: Provide waterproofing materials that are compatible with one another under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

2.4 POST-APPLIED SHEET WATERPROOFING

A. Post-Applied Sheet Waterproofing: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56-mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil-(0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side.
   1. Manufacturers and Products:
      a. AVM Industries Inc.; Aussie Mate 580 AL.
      b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
      c. CETCO Building Materials Group; Envirosheet.
      d. GCP Applied Technologies; Bituthene 3000 or 4000.
      e. Meadows, W. R., Inc.; Mel-Rol.
      f. Polyguard Products, Inc.; Polyguard 650.
      g. Sika Corporation; SikaShield S-60.
      h. Soprema; Colphene 3000.
   2. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.5 PRE-APPLIED (BLINDSIDE) SHEET WATERPROOFING

A. Pre-Applied (Blindside) Sheet Waterproofing for Vertical Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete

placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly.

1. Self-Adhering HDPE Sheet Waterproofing:

   a. Description: Minimum 73-mils (1.85 mm) thick, uniform, flexible sheet membrane consisting of high-density polyethylene film laminated to a layer of waterproofing adhesive and nonwoven geotextile fabric.

      1) Manufacturer and Product: AVM Industries Inc.; Aussie Skin 550G Blindside Waterproofing Membrane.

   b. Description: Minimum 32-mils (0.8 mm) thick, uniform, flexible sheets consisting of 16-mils (0.4 mm) thick HDPE sheet coated with pressure-sensitive rubber adhesive, protective adhesive coating, and release liner.

      1) Manufacturer and Product: GCP Applied Technologies; Preprufe 160R Plus.

   c. Description: Minimum 73-mils (1.85 mm) thick, uniform, flexible sheet membrane consisting of high-density polyethylene film laminated to a layer of waterproofing adhesive and nonwoven geotextile fabric.

      1) Manufacturer and Product: Polyguard Products Inc.; Underseal Blindside Waterproofing Membrane.

2. Self-Adhering TPO Sheet Waterproofing:

   a. Description: Minimum 70-mils (1.78 mm) thick, uniform, flexible sheets consisting of 45-mils (1.14 mm) thick reinforced TPO backing sheet with 25-mil (0.64 mm) butyl alloy membrane / adhesive.

      1) Manufacturer and Product: Carlisle Coatings & Waterproofings; MiraPly V Vertical Blindside Waterproofing.

   b. Description: Minimum 1.10-mm thick, uniform, flexible composite sheet consisting of 0.50 mm thick polyolefin membrane with non-woven polypropylene fleece.

      1) Manufacturer and Product: Sika; SikaProof A-05.

3. Self-Adhering SBS Modified Bitumen Sheet Waterproofing:

   a. Description: Minimum 120-mils (3.0 mm) thick, uniform, flexible sheets consisting of self-adhesive SBS modified bitumen with composite reinforcement and release film.

      1) Manufacturer and Product: Soprema; Colphene BSW V.

4. Self-Adhering Composite Sheet Waterproofing:

   a. Description: Minimum 73-mils (1.85 mm) thick, uniform, flexible composite sheet membrane consisting of an elastomeric membrane bonded to a multi-ply plasmatic matrix and non-woven geotextile fabric.

      1) Manufacturer and Product: W.R. Meadows; PRECON Vertical Blindside Waterproofing Membrane.

5. Thermoplastic Sheet Waterproofing:

   a. Description: Minimum 60-mil (1.5 mm) nominal thick PVC, Elvaloy KEE thermoplastic membrane reinforced with 5 oz. (385 mL) weft inserted knit polyester fabric integrally bonded to an Active Polymer Core (APC)

1) Manufacturer and Product: CETCO Building Materials Group; Coreflex 60.

B. Pre-Applied (Blindside) Sheet Waterproofing for Shotcrete Applications, Non-Hydrostatic Drained Conditions:

1. Description: Minimum 73-mils (1.85 mm) thick, uniform, flexible sheet membrane consisting of high-density polyethylene film laminated to a layer of waterproofing adhesive and nonwoven geotextile fabric.

a. Manufacturer and Product: AVM Industries Inc.; Aussie Skin 550G Blindside Waterproofing Membrane.

2. Description: Minimum 38-mils (0.95 mm) thick, uniform, flexible sheets consisting of 20-mils (0.5 mm) thick HDPE sheet coated with pressure-sensitive rubber adhesive, protective adhesive coating.

a. Manufacturer and Product: GCP Applied Technologies; GCP Applied Technologies; Preprufe 275/275LT.

C. Pre-Applied (Blindside) Sheet Waterproofing for Grout-Injected Shotcrete Applications, Hydrostatic Non-Drained Conditions:

1. Description: Minimum 0.17 in (4.3 mm) thick, uniform, flexible composite sheets consisting of a polymer mesh-reinforced cavity backed by a plastic film and faced with a non-woven, semipermeable geotextile barrier.

a. Manufacturer and Product: GCP Applied Technologies; Preprufe SCS Waterproofing.

D. Pre-Applied (Blindside) Sheet Waterproofing for Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly.

1. Adhesive-Coated HDPE Sheet Waterproofing:

a. Description: Minimum 73-mils (1.85 mm) thick, uniform, flexible sheet membrane consisting of high-density polyethylene film laminated to a layer of waterproofing adhesive and nonwoven geotextile fabric.

1) Manufacturer and Product: AVM Industries Inc.; Aussie Skin 550G Blindside Waterproofing Membrane.

b. Description: Minimum 46-mils (1.2 mm) thick, uniform, flexible sheets consisting of 30-mils (0.76 mm) thick HDPE sheet coated with pressure-sensitive rubber adhesive, protective adhesive coating, detackifying surface treatment, an uncoated self-adhering side lap strip, and release liner.

1) Manufacturer and Product: GCP Applied Technologies; Preprufe 300R Plus.

c. Description: Minimum 85-mils (2.0 mm) thick, uniform, flexible sheet membrane consisting of high-density polyethylene film laminated to a layer of waterproofing adhesive and nonwoven geotextile fabric.

1) Manufacturer and Product: Polyguard Products Inc.; Underseal Underslab Waterproofing Membrane.

2. Adhesive-Coated TPO Sheet Waterproofing:

a. Description: Minimum 70-mils (1.78 mm) thick, uniform, flexible sheets consisting of 45 mils (1.14 mm) thick reinforced TPO backing sheet with 25-mil (0.64 mm) butyl alloy membrane / adhesive.

1) Manufacturer and Product: Carlisle Coatings & Waterproofings; MiraPly H Horizontal Blindside Waterproofing.

b. Description: Minimum 68-mils (1.72 mm) thick, uniform, flexible polyolefin membrane with hybrid bonding layer, mechanical adhesive bond.

1) Manufacturer and Product: Sika; SikaProof A+ 12.

3. SBS Modified Bitumen Sheet Waterproofing:

a. Description: Minimum 140-mils (3.5 mm) thick, uniform, flexible sheets consisting of SBS modified bitumen with polyester reinforcement.

1) Manufacturer and Product: Soprema; Colphene BSW H.

4. Self-Adhering Composite Sheet Waterproofing:

a. Description: Minimum 73-mils (1.85 mm) thick, uniform, flexible composite sheet membrane consisting of an elastomeric membrane bonded to a multi-ply plasmatic matrix and non-woven geotextile fabric.

1) Manufacturer and Product: W.R. Meadows; PRECON Below Grade Underslab Waterproofing Membrane.

5. Thermoplastic Sheet Waterproofing:

a. Description: Minimum 60-mil (1.5 mm) nominal thick PVC, Elvaloy KEE thermoplastic membrane reinforced with 5 oz. (385 mL) weft inserted knit polyester fabric integrally bonded to an Active Polymer Core (APC).

1) Manufacturer and Product: CETCO Building Materials Group; Coreflex 60.

2.6 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. When required by waterproofing manufacturer, obtain Engineer of Record's approval to use manufacturer's recommended waterstops to meet warranty requirements.

B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity, provided by waterproofing manufacturer.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating, provided by waterproofing manufacturer.

F. Mastic and Adhesives: Liquid mastic and adhesives, and adhesive tapes provided by waterproofing manufacturer.

G. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 in (112 mm) wide, with tack-free protective adhesive coating on one side and release film on self-adhering side; provided by waterproofing manufacturer.

H. Termination Bars: Aluminum bars or stainless steel bars ASTM A 666, Type 304; 2 types, one flat and one flat with upper flange shaped to receive sealant, locations as indicated; 1 in by 1/8 in (25 mm by 3 mm) thick; predrilled at 8 in (200 mm) centers; with stainless steel fasteners.

I. Epoxy Grout: High performance, solvent free, impermeable three-part epoxy grout designed to maintain continuity of waterproofing system at structural penetrations.

1. Basis of Design: GCP Applied Technologies; Grout EG 75.

a. Locations: Piles, piers, and similar structural penetrations, other locations recommended by waterproofing manufacturer.

J. Injectable Waterstop: As required by waterproofing manufacturer to ensure watertight installation.

1. Basis of Design: GCP Applied Technologies; INJECTO Tube Groutable Hose Waterstop used with Flex SLV or LV PURe hydrophobic polyurethane chemical grout as recommended by waterproofing manufacturer for this application.

a. Locations: Concrete cold joints at base of foundation, around block-out openings, other locations recommended by waterproofing manufacturer.

K. Waterstop: Polymer/butyl rubber waterstop strip that expands when in contact with water.

1. Basis of Design: GCP Applied Technologies; Adcor 500S.

a. Locations: All typical concrete to concrete cold joints.

L. Expansion Joint System: Heavy-duty, double-celled, thermoplastic extruded sealing gland flanked by integral side flashing sheets. System shall include manufacturer's standard termination bars and anchors. For blind-side below grade applications.

1. Basis of Design: Sika Corp.; Emseal BG System.

M. Tieback Covers: Cover system used to maintain waterproofing integrity at soil retention tieback heads. Provide detail components as recommended by manufacturer for application conditions.

N. Protection Course: As recommended by waterproofing manufacturer for this application.

1. ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:

a. Thickness: Nominal 1/8 inch (3 mm) for vertical applications; 1/4 inch (6 mm) elsewhere.
b. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

O. Hydrophilic Grout: Two-component grout with associated activator components as recommended by manufacturer for application conditions.

1. Port Patch: Rapid curing, portland cement-based product used to repair port holes after injection.

P. Hydrophilic Sealant: Manufacturer's recommended gun-applied moisture-activated swelling mastic for sealing around pipe penetrations, reinforcing steel, utility conduits, and other waterproofing system penetrations.

Q. Grout Injection Tube Components: Provide grout injection tube components furnished by composite sheet waterproofing manufacturer.

1. Injection Base: Specially designed component used to mechanically attach the injection tube to the membrane.
2. Injection Tube: Flexible tube used to deliver grout to the membrane after shotcrete placement.

R. Injection Packer: Button-head, backflow prevention packer used to connect the grout pump to the injection tube.

2.7 MOLDED-SHEET DRAINAGE PANELS

A. Molded-Sheet Drainage Panel with Polymeric Film, Vertical Applications: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing laminated to one side of the core and a polymeric film bonded to the other side (facing waterproofing).

1. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.

a. Minimum Compressive Strength: 15,000 lbf/sf (718 kPa) according to ASTM D 1621.
b. Minimum In-Plane Flow Rate: 15 gpm/ft (188 L/min per m) of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psi (172 kPa) according to ASTM D 4716.

2. Manufacturers and Products:

a. AVM Industries Inc.; Drain Board 6020 XL.
b. CETCO Building Materials Group; 15XP Prefabricated Drainage Composite.
c. GCP Applied Technologies; Hydroduct 220.
d. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 6200.
e. Polyguard Products Inc.; Polyflow 15P.
f. Sika Corporation; SikaDrainage Mat 420.
g. Soprema; Sopradrain 15G.
h. W.R. Meadows; Mel-Drain 5035 B.

B. Molded-Sheet Drainage Panel with Polymeric Film, Horizontal Applications: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing laminated to one side of the core and a polymeric film bonded to the other side (facing waterproofing).

1. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.

a. Minimum Compressive Strength: 18,000 lbf/sf (862 kPa) according to ASTM D 1621.
b. Minimum In-Plane Flow Rate: 18 gpm/ft (225 L/min per m) of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psi (172 kPa) according to ASTM D 4716.

2. Manufacturers and Products:

a. AVM Industries Inc.; Drain Board 6020 XL.
b. CETCO Building Materials Group; 15XP Prefabricated Drainage Composite.
c. GCP Applied Technologies; Hydroduct 660.
d. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 9000.
e. Polyguard Products Inc.; Flow 18-H.

f. Sika Corporation; SikaDrainage Mat 720.
g. Soprema; Sopradrain 18G.
h. W.R. Meadows; Mel-Drain 7055.

C. High-Capacity, Molded-Sheet Collector-Panel System Wrapped with Geotextile: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; wrapped with a nonwoven-geotextile facing. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped sub-drainage system.

1. Compressive Strength per ASTM D1621: 9000 psf (431 kPa) minimum.
2. Flow Rate per ASTM D4716: 17 to 80 gpm per ft. (211 to 994 L/min. per m) minimum.
3. Manufacturers and Products:

a. AVM Industries Inc.; Bottom Drain.
b. CETCO Building Materials Group; Aquadrain 100BD.
c. GCP Applied Technologies; Hydroduct Coil 600.
d. Carlisle Coatings & Waterproofings; CCW MiraDRAIN HC.
e. Polyguard Products Inc.; Totalflow.

D. Drainage Panel Auxiliary Materials.

1. Adhesive for Bonding Drainage Panels: Product compatible with drainage panels being bonded and with demonstrated capability to bond securely to substrates indicated without damaging substrates.
2. Miscellaneous Accessories: As required by manufacturer for complete installation assembly, including flanges around piping penetrations and expanded base and tie-in fittings as necessary to coordination with foundation drainage system.

2.8 INSULATION PANELS

A. Insulation: Comply with Division 7 Section 072100 Thermal Insulation for general building insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.
3. Verify that compacted subgrade or mud slab is dry, smooth, sound, and ready to receive waterproofing sheet.

C. Excavation Support and Protection System:

1. Fill minor gaps and spaces 1/2 in (12 mm) wide or wider with wood, metal, concrete, or other appropriate filling material acceptable to waterproofing manufacturer.
2. Cover or fill large voids and crevices with cement mortar.
3. Encase tieback rods, nuts, and plates with detail tape and prepare for covering with waterproofing.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Applicable provisions of ASTM D 6135.
2. Respective manufacturer's written installation instructions.
3. Accepted submittals.
4. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Excavation Dewatering: Verify that the waterproofing application area is dry and free of standing and uncontrolled water. Should the dewatering system fail at any time during application of waterproofing system, the materials shall be completely removed and work shall start over with new materials once the area is dry and free of water.

C. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

D. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

E. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

F. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

G. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).

H. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

I. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:

a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

J. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D6135.

3.4 INSTALLATION OF POST-APPLIED SHEET WATERPROOFING

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and applicable provisions in ASTM D6135.

B. Primer: Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 6-inch- (150-mm-) minimum lap widths and end laps. Overlap and seal seams with liquid membrane, and stagger end laps to ensure watertight installation. Roll membrane and seams with a hard neoprene roller.

1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).
2. Apply sheets so that direction of flow of water is over and not against laps.
3. Apply sheet strips under waterproofing membrane at, but not limited to, the following locations:

a. Expansion joints.
b. Discontinuous deck-to-wall and deck-to-deck joints.
c. Under clamping ring at drains.
d. Wall angles and corners.
e. Substrate cracks.
f. Penetrations.
g. Isolation, construction and contraction joints.
h. Locations where waterproofing membrane may be subjected to unusual strain.

D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths, to provide a minimum of two thicknesses of sheet membrane over areas to receive waterproofing.

E. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.

F. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

G. Waterproofing Tie-Ins: Install waterproofing and accessories to tie into adjacent waterproofing to ensure watertight installation.

H. Termination and Penetration Treatment: Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves.

1. Unless indicated otherwise, terminate top edges of sheets under metal counterflashings or with metal termination bars and sealants.

2. Seal all exposed sheet edges at terminations, vertical and horizontal, not concealed by metal counterflashings or metal termination bars and sealants with liquid membrane or mastic.

I. Damaged Waterproofing: Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches (150 mm) beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

1. Patch tears, voids, misaligned or inadequately lapped seams.
2. Slit fishmouths and blisters, overlap flaps, and patch.

J. Immediately install protection course with butted joints over waterproofing membrane.

1. Molded-sheet drainage panels or insulation panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.5 INSTALLATION OF PRE-APPLIED (BLINDSIDE) SHEET WATERPROOFING

A. Install blindside sheet waterproofing according to manufacturer's written instructions.

B. Molded-Sheet Drainage Panels at Vertical Applications: Place and secure over substrate with adhesive, with geotextile filter fabric facing excavation support and protection system. Lap edges and ends of geotextile filter fabric to maintain continuity. Protect installed drainage panels during subsequent construction.

C. Vertical Applications: Install sheet with appropriate face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.

1. Seams and Laps: Install 12-inch strip of post-applied membrane sheet strips behind laps and 4-inch strip of membrane detail tape over front of lap. Additionally at field cut seams, provide a 6-inch overlap with a full bed of liquid membrane. Roll membrane and seams with hard neoprene roller.
2. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detail tape.

D. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.

1. Seams and Laps: Install 12-inch strip of post-applied membrane sheet strips behind laps and 4-inch strip of membrane detail tape over front of lap. Additionally at field cut seams, provide a 6-inch overlap with a full bed of liquid membrane. Roll membrane and seams with hard neoprene roller.

E. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.

F. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.

G. Waterproofing Tie-Ins: Install waterproofing and accessories to tie into adjacent waterproofing to ensure watertight installation.

H. Termination and Penetration Treatment: Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves.

I. Damaged Waterproofing: Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches (150 mm) beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.6 INSTALLATION OF INSULATION PANEL

A. Install insulation panels over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.

B. On vertical surfaces, set insulation drainage panels in adhesive or tape applied according to manufacturer's written instructions.

1. Install board insulation before installing molded sheet drainage panels.

C. On horizontal surfaces, loosely lay insulation drainage panels according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.7 INSTALLATION OF MOLDED-SHEET DRAINAGE PANEL

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.8 GROUT-INJECTION

A. After assembly of shotcrete bar reinforcement, attach injection port components to composite sheet. Secure injection port tube on steel reinforcement with wire ties.

B. Following application and curing of shotcrete, inject hydrophilic grout into composite sheet cavity in accordance with manufacturer's instructions. Completely fill cavity; avoid overfilling.

1. Do not inject grout until strength of shotcrete exceeds 1500 psi (10.35 MPa) or 7 days have elapsed from time of application.
2. Maintain grout at minimum temperature of 50 deg. F (10 deg. C) for 24 hours prior to use. Do not exceed product temperature of 90 deg. F (32 deg. C).

C. Upon completing injection and curing of grout, cut injection tubes flush with face of shotcrete and patch with port patch.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
2. Final Inspection: Arrange for waterproofing system manufacturer's qualified technical representative to inspect waterproofing installation on completion of waterproofing

membrane and flashing. Notify Architect and Owner 48 hours in advance of date and time of final inspection.

B. Owner Testing Agency: The Owner shall employ and pay a qualified independent testing agency to perform field quality control.

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

C. Contractor Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Agency shall be certified by waterproofing manufacturer to provide observations and inspections required to provide warranty indicated.

   a. Agency shall prepare reports and digital photographs documenting observations. Reports shall be made available to the Contractor, waterproofing installer, waterproofing manufacturer and Architect.

2. Pre-Applied Sheet Waterproofing: Including but not limited to the following:

   a. Prior to beginning concrete slab reinforcing installation, inspect waterproofing membrane for rips, tears, and punctures.
   b. Prior to concrete placement work, inspect concrete installer's tools and notify Contractor to have tools with spikes or other sharp surfaces that could inflict intentional or unintentional damage on the installed waterproofing membrane removed from work area.
   c. Immediately prior to concrete placement work, inspect waterproofing membrane for rips, tears, and punctures, inspect penetrations at columns and mechanical and electrical piping.
   d. Continuously inspect concrete placement work, watching for damage to waterproofing membrane.
   e. Periodically inspect portions of slab that were not placed (block-outs, voids, and leave-outs) for water infiltration of subgrade until concrete is subsequently placed.

3. Correction of Deficiencies:

   a. Materials and installation will be considered defective if they do not meet specified requirements.
   b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
   c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

4. Prepare test and inspection reports.

D. Contractor Flood Testing: Flood test each drain area for leaks, according to procedures in ASTM D5957, after completing waterproofing but before placing overlying construction. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches (64 mm) with a minimum depth of 1 inch (25 mm) and a maximum depth of 4 inches (100 mm). Maintain 2 inches (51 mm) of clearance from top of sheet flashings.
2. Flood each area for 24 hours.
3. Examine underside of decks and terminations for evidence of leaks during flood testing.
4. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

E. Contractor Electronic Leak-Detection Testing, Electronic Field Vector Mapping (EFVM): Perform leak testing by an electronic detection process to verify entire waterproofing membrane is free of defects. EFVM shall be performed by a qualified testing agency.

1. Test each deck area for leaks using an electronic leak-detection method that locates discontinuities, holes, open seams, and capillary defects in the waterproofing membrane.

   a. Perform leak detection of horizontal waterproofing membrane prior to placement of protection board and remaining system components

2. Perform tests on abutting or overlapping smaller areas as necessary to cover entire test area.
3. Create a conductive electronic field over the area of waterproofing to be tested and electronically determine locations of discontinuities or leaks, if any, in the waterproofing.
4. Provide survey report indicating locations of discontinuities, if any.

3.10 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Protect installed insulation panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 071800
TRAFFIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Traffic coatings and supplementary items necessary for application.

1. Pedestrian traffic coating systems.
2. Pedestrian traffic coating systems, heavy duty.
3. Vehicular traffic coating systems, heavy duty.
4. Pedestrian and vehicular PUMA/PMMA traffic coating systems.

B. Related Requirements:

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include installation instructions and details, material descriptions, dry- or wet-film thickness requirements, finish., and recommendations for maintenance.

B. Shop Drawings: Show extent of each traffic coating.

1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions that are not included in manufacturer's product data.
2. Include manufacturer's written approval of shop drawings prior to submission.

C. Samples for Verification Purposes: For each type of traffic coating required, prepared on rigid backing and of same thickness and material indicated for the Work.

1. Provide stepped samples on backing large enough to illustrate build-up of traffic coatings.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1. Product Certificates: For each type of traffic coating.

B. Field Quality Control Reports: Written report of testing and inspection required by “Field Quality Control”.

C. Warranty:

1. Provide manufacturer’s written warranty covering materials and application (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals. Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of traffic coatings.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Applicator Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.

a. Show typical components and requirements of installation.
b. Size: 100 sq. ft. (9 sq. m) of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-APPLICATION CONFERENCE

A. Pre-Application Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.

e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels showing the following information:

1. Manufacturer's brand name.
2. Type of material.
3. Directions for storage.
4. Date of manufacture and shelf life.
5. Lot or batch number.
6. Mixing and application instructions.
7. Color.

B. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F (5 deg C), when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.

1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of the substrate.

B. Do not apply traffic coating until items that will penetrate membrane have been installed.

1.9 COORDINATION

A. Coordinate application of products and systems with interfacing and adjoining construction to provide a successful application without failure.

1.10 WARRANTY

A. Manufacturer’s Warranty: Furnish manufacturer’s written material and labor warranty signed by an authorized representative using manufacturer’s standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and application of product. “Defects” is defined to include but not limited to deterioration or failure to perform as required.

1. Defects of traffic coatings includes, but is not limited to, the following:

a. Adhesive or cohesive failures.
b. Abrasion or tearing failures.
c. Surface crazing or spalling.
d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.

2. Warranty does not include deterioration or failure of traffic coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new

substrate cracks exceeding 1/16 in (1.5 mm) in width, fire, vandalism, or abuse by maintenance equipment.

3. Warranty Period - Vehicular and Pedestrian Traffic Coatings: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion.
4. Warranty Period - Vehicular and Pedestrian PUMA/PMMA Traffic Coatings: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.

B. Installer Warranty: Furnish installer written warranty signed by an authorized representative using installer standard form agreeing to provide materials and labor required to repair or replace Work which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by manufacturer listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Sika Corp..
2. Gaco Western.
3. Neogard.
4. Pacific Polymers International, Inc.
5. Pecora Corporation.
6. Sherwin Williams High Performance Flooring.
7. Tremco Incorporated.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Pedestrian Traffic Coating System - Mechanical Equipment Rooms:

a. Basis of Design: Neogard; Peda-Gard M.

2. Pedestrian Traffic Coating System, Heavy Duty:

a. Basis of Design: Neogard; Peda-Gard FC.

3. Vehicular Traffic Coating System, Heavy Duty:

a. Basis of Design: Neogard; Auto-Gard FC.

4. Pedestrian and Vehicular PMMA/PUMA Traffic Coating System:

a. Basis of Design: Neogard; RTS Vehicular System.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

C. Fire-Test-Response Characteristics: Provide traffic-coating materials with the fire-test-response characteristics as determined by testing identical products according to test method below for deck type and slopes indicated by an independent testing and inspecting agency that is acceptable to authorities having jurisdiction.

1. Roof Coverings: Class A roof covering according to ASTM E108.
2. Mechanical/Equipment-Rooms Used for Return Air Plenum: Provide materials identical to those of traffic coatings tested according to ASTM E 84, where used in areas serving as a return air plenum that comply with requirements indicated.

a. Flame spread less than 25.
b. Smoke Density less than 50.

D. Regulatory Requirements: Provide products that comply with local regulations controlling use of volatile organic compounds (VOCs).

E. Energy Star Listing: Provide traffic coating that is listed on the DOE's Energy Star "Roof Products Qualified Product List" for low-slope roof products.

F. Energy Performance: Provide traffic coating with an initial Solar Reflectance Index of not less than 0.70 and emissivity of not less than 0.75 when tested according to CRRC-1.

2.4 TRAFFIC COATINGS

A. Traffic Coating: Manufacturer's standard, traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for service condition; according to ASTM C957/C957M.

B. Primer: Liquid primer as recommended in writing for substrate and conditions by traffic-coating manufacturer.

1. Material: Epoxy or as recommended by manufacturer for substrate.

C. Preparatory and Base Coats: Single- or multi-component as recommended by manufacturer.

1. Thicknesses: Minimum dry or wet film thickness as recommended in writing by manufacturer for substrate and service conditions indicated.

D. Intermediate Coat: Single- or multi-component as recommended by manufacturer.

1. Thicknesses: Minimum dry or wet film thickness as recommended in writing by manufacturer for substrate and service conditions indicated.

E. Aggregate: Manufacturer's standard aggregate for each use indicated of particle sizes, shape, and minimum hardness recommended in writing by traffic-coating manufacturer.

1. Aggregate Content: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated.

F. Top Coat: Single- or multi-component as recommended by manufacturer with UV inhibitors.

1. Thicknesses: Minimum dry or wet film thickness as recommended in writing by manufacturer for substrate and service conditions indicated, measured excluding aggregate.
2. Aggregate: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated, and as required to achieve slip-resistant finish.
3. Chemical Resistant Topcoat: At locations exposed to chemical spills, provide chemical resistant topcoat as recommended in writing by traffic-coating manufacturer.
4. Topcoat Finish: As required to achieve slip-resistant finish.

a. Coefficient of Friction: Coefficient of friction shall be not less than 0.6 for level surfaces and 0.8 for ramps, when tested according to ASTM C 1028 (field test) or ASTM D 2047 (laboratory test).

5. Color: As scheduled or as indicated in Design Selections.

2.5 ACCESSORY MATERIALS

A. Joint Sealants: As specified in Division 07 Section "Joint Sealants".

B. Sheet Flashing: Non-staining sheet material recommended in writing by traffic-coating manufacturer or uncured neoprene sheet.

1. Thickness: Minimum 52 mils (1.3 mm).

C. Adhesive: Contact adhesive recommended in writing by traffic coating manufacturer.

D. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Verify that substrates are visibly dry and free of moisture.

a. Test for moisture according to ASTM D4263 or method recommended in writing by traffic-coating manufacturer.

2. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

a. Begin coating application only after substrate construction and penetrating work have been completed.
b. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.

3.2 APPLICATION, GENERAL

A. Application Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written application instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective application or would cause latent defects in Work.

B. Clean and prepare substrates according to ASTM C1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.

C. Priming: Unless manufacturer recommends in writing against priming, prime substrates according to manufacturer's written instructions.

1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.

D. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

E. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.

F. Concrete Substrates: Mechanically abrade concrete surfaces to a uniform profile according to ASTM D 4259 using self-contained recirculating blast cleaning apparatus and manufacturer’s recommendations. Do not acid etch.

1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
2. Remove concrete fins, ridges, and other projections.
3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.

3.4 TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written recommendations.

B. Provide sealant cants at penetrations and at reinforced and nonreinforced deck-to-wall butt joints.

C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.5 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and traffic coating manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Comply with recommendations in ASTM C 1193 for joint-sealant installation.

3.6 TRAFFIC COATING APPLICATION

A. Apply traffic coating material according to ASTM C 1127 and manufacturer's written recommendations.

B. Apply coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.

C. Unless approved otherwise by Architect, start traffic-coating application in presence of manufacturer's technical representative.

D. Verify that wet-film thickness of each coat complies with requirements every 100 sq. ft. (9 sq. m).

1. Verify applied thickness before material attains final set, by use of mil-thickness gage as work progresses. Immediately apply additional coating to produce required thickness where readings indicate thickness less than that specified.

E. Uniformly broadcast and embed aggregate in each coat indicated to receive aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.

F. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.

G. Cure traffic coatings. Prevent contamination and damage during coating application and curing.

H. Pedestrian Traffic Coating System: Apply primer, base, intermediate, and top coats and aggregate according to traffic coating manufacturer's recommendations and as follows:

1. Pedestrian Traffic Coating System: Apply a minimum total dry film thickness of 32 mils (0.8 mm), excluding substrate primer and aggregate.

a. Aggregate: Apply aggregate at a minimum rate of 8 to 10 lb/100 sf (3.6 to 4.5 kg/10 sm) and backroll to imbed.
b. Locations:

1) Interior mechanical equipment rooms.

2. Pedestrian Traffic Coating System, Heavy Duty: Apply a minimum total dry film thickness of 48 mils (1.2 mm), excluding substrate primer and aggregate.

a. Aggregate: Apply silica aggregate at minimum rate of 10 to 15 lb/100 sf (4.5 to 6.6 kg/10 sm).
b. Locations:

1) Exterior walkways or balconies.
2) Locations scheduled or indicated on Drawings.

I. Vehicular Traffic Coating System: Apply base, intermediate, and top coats and aggregate according to traffic coating manufacturer's written recommendations and as follows:

1. Vehicular Traffic Coating System, Heavy Duty: Apply a minimum total dry film thickness of 60 mils (1.5 mm), excluding substrate primer and aggregate.

a. Aggregate: Apply aggregate at minimum rate of 20 to 25 lb/100 sf (9.0 to 10.1 kg/10 sm).
b. Location:

1) Top level of parking garage.
2) All levels of parking garage.
3) Ventilation air shaft floors.
4) Locations scheduled or indicated on Drawings.

J. Pedestrian and Vehicular Traffic PUMA/PMMA System: Apply primer, membrane, body coat, and top coats and aggregate according to traffic coating manufacturer's written recommendations and as follows:

1. Pedestrian and Vehicular Traffic PUMA/PMMA System - Above Occupied Spaces: Apply a minimum total dry film thickness as recommended by manufacturer.

a. Location:

1) Locations above occupied spaces.
2) Locations scheduled or indicated on Drawings

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
2. Final Inspection: Arrange for waterproofing system manufacturer's qualified technical representative to inspect waterproofing installation on completion of waterproofing membrane and flashing. Notify Architect and Owner 48 hours in advance of date and time of final inspection.

B. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.8 PROTECTING AND CLEANING

A. Protect traffic coatings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 COLOR SCHEDULE

A. Color: As selected by Architect from manufacturer's standard colors.

B. Color: As selected by Architect from manufacturer's custom colors.

C. TC01:

1. Type:
2. Color:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 071813
EPOXY TRAFFIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Epoxy traffic coatings and supplementary items necessary for application.

1. Exposure 3 Heavy Duty - Pedestrian and Vehicular Areas.
2. Exposure 4 Extra Heavy Duty - Loading Areas.

B. Related Requirements:

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, application instructions, and recommendations for maintenance.

B. Shop Drawings: Show extent of each traffic coating.

1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions that are not included in manufacturer's product data.
2. Include manufacturer's written approval of shop drawings prior to submission.

C. Samples for Verification Purposes: For each type of traffic coating required, prepared on rigid backing and of same thickness and material indicated for the Work.

1. Provide stepped samples on backing large enough to illustrate build-up of traffic coatings.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

C. Field Quality Control Reports: Written report of testing and inspection required by “Field Quality Control”.

D. Warranty:

1. Provide manufacturer’s written warranty covering materials and application (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals. Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of traffic coatings.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Applicator Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Fire-Test-Response Characteristics: Provide traffic coating materials with the fire-test-response characteristics as determined by testing identical products per test method below for deck type and slopes indicated by an independent testing and inspecting agency that is acceptable to authorities having jurisdiction.

D. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.

a. Show typical components and requirements of installation.
b. Size: 100 sq. ft. (9 sq. m) of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-APPLICATION CONFERENCE

A. Pre-Application Conference: Before Work begins, conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels showing the following information:

1. Manufacturer's brand name.
2. Type of material.
3. Directions for storage.
4. Date of manufacture and shelf life.
5. Lot or batch number.
6. Mixing and application instructions.
7. Color.

B. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F (5 deg C), when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.

1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of the substrate.

B. Do not apply traffic coating until items that will penetrate membrane have been installed.

1.9 COORDINATION

A. Coordinate application of products and systems with interfacing and adjoining construction to provide a successful application without failure.

1.10 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and application of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Defects of traffic coatings includes, but is not limited to, the following:

a. Adhesive or cohesive failures.
b. Abrasion or tearing failures.
c. Surface crazing or spalling.
d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by manufacturer listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

C. Fire-Test-Response Characteristics: Provide traffic-coating materials with the fire-test-response characteristics as determined by testing identical products according to test method below for deck type and slopes indicated by an independent testing and inspecting agency that is acceptable to authorities having jurisdiction.

D. Regulatory Requirements: Provide products that comply with local regulations controlling use of volatile organic compounds (VOCs).

2.4 TRAFFIC COATINGS

A. Epoxy Traffic Coating: Manufacturer's standard, traffic-bearing, seamless, high-solids-content, cold liquid-applied, water-resistant membrane system with integral wearing surface for service condition; according to ASTM C957/C957M.

1. Basis of Design: Technical Barrier Systems Inc.; Kelmar TE System.

B. Primer: Epoxy primer as recommended in writing for substrate and conditions by traffic-coating manufacturer.

C. Waterproofing Membrane: Elastomeric waterproofing membrane as recommended in writing for substrate and conditions by traffic-coating manufacturer.

D. Preparatory and Base Coats: Epoxy wear course as recommended in writing for substrate and conditions by traffic-coating manufacturer.

1. Thicknesses: Minimum dry or wet film thickness as recommended in writing by manufacturer for substrate and service conditions indicated.

E. Top Coat: UV resistant epoxy top coat as recommended in writing by manufacturer for substrate and service conditions indicated.

1. Thicknesses: Minimum dry or wet film thickness as recommended in writing by manufacturer for substrate and service conditions indicated, measured excluding aggregate.
2. Aggregate Content: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated, and as required to achieve slip-resistant finish.

F. Aggregate: Manufacturer's standard aggregate for each use indicated of particle sizes, shape, and minimum hardness recommended in writing by traffic-coating manufacturer.

2.5 ACCESSORY MATERIALS

A. Joint Sealants: As specified in Division 07 Section "Joint Sealants".

B. Sheet Flashing: Non-staining sheet material recommended in writing by traffic-coating manufacturer.

1. Thickness: Minimum 60 mils (1.5 mm).

C. Adhesive: Contact adhesive recommended in writing by traffic coating manufacturer.

D. Reinforcing Strip: Fabric mesh recommended in writing by traffic coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Verify that substrates are visibly dry and free of moisture.

a. Test for moisture according to ASTM D4263 or method recommended in writing by traffic-coating manufacturer.

2. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

a. Begin coating application only after substrate construction and penetrating work have been completed.
b. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.

3.2 APPLICATION, GENERAL

A. Application Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written application instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective application or would cause latent defects in Work.

B. Clean and prepare substrates according to ASTM C1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove

projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.

C. Priming: Unless manufacturer recommends in writing against priming, prime substrates according to manufacturer's written instructions.

1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.

D. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

E. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.

F. Concrete Substrates: Mechanically abrade concrete surfaces to a uniform profile according to ASTM D 4259 using self-contained recirculating blast cleaning apparatus and manufacturer’s recommendations. Do not acid etch.

1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
2. Remove concrete fins, ridges, and other projections.
3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.

3.4 TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written recommendations.

B. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.5 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and traffic coating manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Comply with recommendations in ASTM C 1193 for joint-sealant installation.

3.6 TRAFFIC COATING APPLICATION

A. Apply traffic coating material according to ASTM C 1127 and manufacturer's written recommendations.

B. Apply coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.

C. Unless approved otherwise by Architect, start traffic-coating application in presence of manufacturer's technical representative.

D. Verify that wet-film thickness of each coat complies with requirements every 100 sq. ft. (9 sq. m).

E. Uniformly broadcast and embed aggregate in each coat indicated to receive aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.

F. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.

G. Cure traffic coatings. Prevent contamination and damage during coating application and curing.

H. Epoxy Traffic Coating: Apply primer, base, intermediate, and topcoats and aggregate in nominal thicknesses according to traffic coating manufacturer's recommendations and as follows:

1. Prime entire surface with recommended primer.
2. Install elastomeric membrane at a total minimum dry film thickness of twenty (20) mils.
3. Install elastomeric membrane at an approximate height of 3 to 4 inches (75 to 100 mm) to columns, curbs and walls or as directed.
4. Apply epoxy wear course surfacing and manufacturer-approved aggregate, having a minimum hardness of six (6) on the Moh Scale, at the recommended coverage.
5. Exposure 3 Heavy Duty - Pedestrian and Vehicular Areas:

   a. Apply epoxy wear course surfacing in multiple coats, to a total dry film thickness of 46 mils minimum; approximately 71 mils for the total system, excluding aggregate.
   b. Locations:

      1) Locations indicated on Drawings.

6. Exposure 4 - Extra Heavy Duty - Loading Areas:

   a. Apply epoxy wear course surfacing in multiple coats to a total dry film thickness of 69 mils minimum; approximately 94 mils for total system, excluding aggregate.
   b. Locations:

      1) Locations indicated on Drawings.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
2. Final Inspection: Arrange for waterproofing system manufacturer's qualified technical representative to inspect waterproofing installation on completion of waterproofing membrane and flashing. Notify Architect and Owner 48 hours in advance of date and time of final inspection.

B. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:
   a. Materials and installation will be considered defective if they do not meet specified requirements.
   b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
   c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
2. Prepare test and inspection reports.

3.8 PROTECTING AND CLEANING

A. Protect traffic coatings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 071900
WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes penetrating water repellent and supplementary items necessary to complete work required for its installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1. Certification by water repellent manufacturer that products supplied complies with local regulations controlling use of VOCs.

B. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Regulatory Requirements: Comply with applicable rules of pollution-control regulatory agency having jurisdiction in Project locale regarding VOCs and use of hydrocarbon solvents.

D. Field Samples: Select one representative surface for each substrate to receive water repellents. Apply water repellent to each substrate, with either partial or full coverage as directed. Comply with application requirements of this Section.

1. Obtain approval of field samples before applying water repellents.
2. Maintain field samples during construction in an undisturbed condition as a standard for judging the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:

1. Ambient temperature is less than 40 deg F (4.4 deg C).
2. Concrete surfaces have cured for less than 28 days.
3. Rain or temperatures below 40 deg F (4.4 deg C) are predicted within 24 hours.
4. Application is earlier than 24 hours after surfaces have been wet.
5. Substrate is frozen or surface temperature is less than 40 deg F (4.4 deg C).
6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

1. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 in (1.5 mm) wide, fire, vandalism, or abuse by maintenance equipment.
2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Advanced Chemical Technologies, Inc.
2. Anti Hydro International, Inc
3. L&M Construction Chemicals, Inc.
4. Nox-Crete Products Group
5. PROSOCO, Inc.
6. Textured Coatings of America, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.

1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens, per ASTM C642.
2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
3. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
4. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 53.
5. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1653.
6. Chloride-Ion Intrusion in Horizontal Concrete: Transportation Research Board, National Research Council's NCHRP Report 244, Series II tests.

a. Reduction of Water Absorption: 80 percent.
b. Reduction in Chloride Content: 80 percent.

2.3 WATER REPELLENTS

A. Vertical Applications: Silane, 20 Percent Solids: Penetrating water repellent for vertical application. A monomeric compound containing approximately 20 percent alkyltrialkoxysilanes. and meeting VOC requirements.

B. Horizontal Applications: Silane, 40 Percent Solids: Penetrating water repellent for horizontal application. A monomeric compound containing approximately 40 percent alkyltrialkoxysilanes and meeting VOC requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates surfaces to receive water repellents and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors

which would result in poor or potentially defective installation or would cause latent defects in Work

B. Test for pH level, according to water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.

C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

E. Test Application: Before performing water-repellent work, including bulk purchase and delivery of products, prepare a small application in an unobtrusive location and in a manner approved by Architect to demonstrate the final effect (visual, physical, and chemical) of planned application. Proceed with work only after Architect approves test application or as otherwise directed.

3.4 APPLICATION

A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.

1. Architectural Precast Concrete: At Contractor's option, first application of water repellent on precast concrete units may be completed before installing units. Mask sealant-bond surfaces to prevent water repellent from migrating onto joint surfaces.

B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.5 CLEANING

A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.

B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

3.6 SCHEDULE

A. Apply water repellents to following areas:

1. Architectural precast concrete panels.
2. Cast stone units.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 072100
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Thermal insulation and supplementary items necessary for installation.

1. Extruded polystyrene foam-plastic board insulation.
2. Mortar faced, extruded polystyrene foam-plastic board insulation.
3. Molded (expanded) polystyrene foam-plastic board insulation.
4. Glass-fiber blanket insulation.
5. Glass-fiber board insulation.
6. Mineral-wool blanket insulation.
7. Mineral-wool board insulation.
8. Thin profile, high thermal blanket insulation.
9. Loose-fill insulation.
10. Spray-applied glass fiber insulation.
11. Polyethylene vapor retarder membrane.

B. Related Requirements:

1. Refer to Division 03 Section Expanded Polystyrene Foam Block Formwork expanded polystyrene rigid insulation used for foam block fill.
2. Refer to Division 03 Section Lightweight Insulating Concrete for expanded polystyrene rigid insulation used as a component in lightweight insulating concrete under roof membrane.
3. Refer to Division 04 Section Concrete Unit Masonry for insulation installed in masonry cells.
4. Refer to Division 07 Section EIFS for expanded polystyrene rigid insulation used as a component in EIFS.
5. Refer to Division 07 Sections for Roofing sections with insulation specified as part of roofing construction.
6. Refer to Division 09 Section Gypsum Board Assemblies for sound attenuation blankets used as acoustic insulation.

1.2 DEFINITIONS

A. Mineral Fiber: Insulation composed principally of fibers manufactured from rock, slag, or glass, with or without binders. Mineral fiber includes “glass fiber” insulation and “mineral wool” insulation.

B. Mineral Wool: A synthetic vitreous fiber insulation made by melting predominantly igneous rock, and/or furnace slag and other inorganic material, physically forming the melt into fibers.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings for Spray-Applied Thermal Insulation: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work.

1. Indicate locations and types of surface preparations required before applying spray-applied thermal insulation.
2. Indicate extent of minimum thicknesses needed to achieve required thermal rating, color, and texture.
3. Treatment of spray-applied thermal insulation after application.

C. Samples of Spray-Applied Thermal Insulation for Verification: For each exposed product of each color and texture specified, 12-inch (300 mm) square in size.

D. Insulation Schedule: Include the following information:

1. Insulation type and location.
2. Insulation manufacturer and product name.
3. Insulation method of installation and fastening.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Project Acceptance Document for Spray-Applied Thermal Insulation: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

B. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope unless labeled by manufacturer.

1. For blown-in or sprayed insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
2. Sign, date, and post the certification in a conspicuous location on Project site.

C. Product Test Reports for Spray-Applied Thermal Insulation: Written reports based on evaluation of comprehensive tests performed by qualified testing agencies indicating that each product complies with requirements.

1. Certificates: Furnish manufacturer's certification that spray-applied thermal insulation is free of asbestos (including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite), or other toxic materials.
2. Compatibility and Adhesion Test Reports: From manufacturer indicating the following:

a. Materials have been tested for bonding with substrates.
b. Materials have been verified by spray-applied thermal insulation manufacturer to be compatible with substrate primers and coatings.
c. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

D. Research Reports: For foam-plastic insulation, from ICC-ES.

E. Field Quality Control Reports for Spray Thermal Insulation: Written report of testing and inspection required by Field Quality Control.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications for Spray-Applied Thermal Insulation:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.

2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.6 MOCKUP FOR SPRAY-APPLIED THERMAL INSULATION

A. Mock-ups: Prior to installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Participants:

1. Architect.
2. Contractor, including superintendent.
3. Installer, including project manager and supervisor.
4. If requested, Manufacturer's qualified technical representative.
5. Installers of other construction interfaced with Work.

B. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

1. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
2. Review Contract Document requirements.
3. Review accepted submittals.
4. Review inspection and testing requirements.
5. Review environmental conditions and procedures for coping with unfavorable conditions.
6. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

C. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation materials in original packaging with identification labels intact. Ensure that insulation materials are not exposed to moisture during delivery.

B. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

C. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

D. Protect mineral-wool insulation by storing materials off ground, away from harmful conditions, and at temperature conditions recommended by manufacturer. Store in original packaging.

1.9 FIELD CONDITIONS FOR SPRAY-APPLIED THERMAL INSULATION

A. Environmental Limitations: Do not apply sprayed thermal insulation when ambient or substrate temperature is 34 deg F (1 deg C) or lower, unless temporary protection and heat are provided to maintain temperature at or above this level until material is dry and firm to the touch, completely cured through to substrate.

B. Ventilation: Ventilate building spaces during and after application of sprayed thermal insulation and provide complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until sprayed thermal insulation is fully cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from a single manufacturer. Provide secondary materials only as recommended by the manufacturer of primary materials.

B. General: Provide insulating materials that comply with requirements and referenced standards in sizes to fit applications indicated, selected from manufacturer’s standard thicknesses, widths, and lengths.

2.3 PERFORMANCE REQUIREMENTS, GENERAL

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Fire Rated Assemblies: Provide materials and assemblies selected from UL Fire Resistance Directory for fire-resistance rated designs, or other Testing Agency acceptable to Authorities Having Jurisdiction.

C. Surface Burning Characteristics: Provide materials and assemblies tested in accordance with ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

D. Combustibility: Provide materials and assemblies tested in accordance with ASTM E136 Standard Test Method for Assessing Combustibility of Materials.

E. Plenum Rated: Provide materials and assemblies tested in accordance with UL 181 Standard Closure Systems for Use with Flexible Air Ducts and Air Connectors, or other independent testing agency acceptable to Authorities Having Jurisdiction.

1. Air Erosion Testing: No evidence of fiber erosion after initial blowdown.
2. Mold Growth and Humidity Testing: No evidence of microbial growth, delamination or other deterioration resulting from high humidity conditions.

2.4 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (EXTRUDED POLYSTYRENE RIGID INSULATION)

A. Performance Requirements:

1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width unless installer provides certification.

B. Extruded Polystyrene Board Insulation (XPS): ASTM C578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced.

1. Manufacturers:

a. DiversiFoam Products; CertiFoam 25.
b. Dupont; STYROFOAM Square Edge.
c. Owens Corning; FOAMULAR 250.

2. Locations:

a. Backfilled walls, as indicated on Drawings.
b. Planters.

C. Extruded Polystyrene Board Insulation (XPS): ASTM C578, Type VI, 40-psi (276-kPa) minimum compressive strength.

1. Manufacturers:

a. DiversiFoam Products; CertiFoam 40.
b. Dupont; STYROFOAM Roofmate or Highload 40.
c. Owens Corning; FOAMULAR 400 or 404.

2. Locations:

a. Below slabs-on-grade, as indicated on Drawings.
b. Pedestrian walkways on split slabs over elevated decks at Grade.
c. Pedestrian walkways on split slabs over elevated decks above Grade.
d. Vehicular drives on split-slabs over elevated decks in Parking Garages.

D. Extruded Polystyrene Board Insulation (XPS): ASTM C578, Type VII, 60-psi (414-kPa) minimum compressive strength.

1. Manufacturers:

   a. DiversiFoam Products; CertiFoam 60.
   b. Dupont; STYROFOAM Plazamate or Highload 60.
   c. Owens Corning; FOAMULAR 600 or 604.

2. Locations:

   a. Landscaping or vegetative roofing over elevated decks.

E. Extruded Polystyrene Board Insulation (XPS): ASTM C578, Type V, 100-psi (690-kPa) minimum compressive strength.

1. Manufacturers:

   a. Dupont; STYROFOAM Highload 100.
   b. Owens Corning; FOAMULAR 1000.

2. Locations:

   a. Vehicular drives, truck docks on split-slabs over elevated decks at Grade
   b. As indicated on Drawings.

2.5 MORTAR-FACED, EXTRUDED-POLYSTYRENE FOAM PLASTIC BOARD INSULATION

A. Performance Requirements:

1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width unless installer provides certification.

B. Mortar-Faced, Extruded Polystyrene Board Insulation (XPS-MF): ASTM C578, Type VI, 40-psi (276-kPa) minimum compressive strength, tongue-and-groove edges on long dimension, minimum 3/8-inch (10 mm) latex-modified cement mortar topping.

1. Manufacturers:

   a. Sika, Sarnatherm Lightguard.
   b. T. Clear Corporation, Lightguard.

2. Locations:

   a. Pedestrian walkways on pedestal paver assemblies over elevated decks.

C. Mortar-Faced, Extruded Polystyrene Board Insulation (XPS-MF): ASTM C578, Type VI, 40-psi (276-kPa) minimum compressive strength, tongue-and-groove edges on long dimension, minimum 15/16-inch (10 mm) latex-modified cement mortar topping.

1. Manufacturers:

   a. Sika, Sarnatherm Heavyguard.
   b. T. Clear Corporation, Heavyguard.

2. Locations:

   a. Pedestrian walkways on pedestal paver assemblies over elevated decks.

2.6 MOLDED (EXPANDED) POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (EXPANDED POLYSTYRENE RIGID INSULATION)

A. Performance Requirements:

1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.

2. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width unless installer provides certification.

B. Molded (Expanded) Polystyrene Board Insulation (EPS): ASTM C578, Type II, 15-psi (104-kPa) minimum compressive strength.

2.7 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Refer to Division 07 Roofing Sections for polyisocyanurate rigid insulation used as roofing insulation.

2.8 GLASS-FIBER BLANKET INSULATION (GLASS MINERAL FIBER BATT INSULATION)

A. Performance Requirements:

1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width unless installer provides certification.

B. Glass-Fiber Blanket Insulation, Unfaced (GF-U): ASTM C665, Type I; passing ASTM E136 for combustion characteristics, free of formaldehyde.

1. Manufacturers:

a. CertainTeed Corporation; CertaPro Sustainable Insulation.
b. Johns Manville; a Berkshire Hathaway company; Unfaced.
c. Knauf Insulation; EcoBatt with ECOSE Technology.
d. Owens Corning; EcoTouch Thermal.

2. Thickness: Full depth of metal stud cavity unless indicated otherwise.
3. Adhesive or Sealing Tape: Product provided or recommended by manufacturer with demonstrated capability to bond securely to substrates indicated.
4. Locations:

a. Exterior stud framed assemblies.
b. As indicated on Drawings.

C. Glass-Fiber Blanket Insulation, Reinforced-Foil Faced (GF-F): ASTM C665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene, free of formaldehyde.

1. Manufacturers:

a. CertainTeed Corporation; CertaPro Sustainable Insulation FSK-25.
b. Johns Manville; a Berkshire Hathaway company; FSK-25 Faced.
c. Knauf Insulation; EcoBatt with ECOSE Technology, FSK-25 Faced.
d. Owens Corning; EcoTouch Thermal FSK-25 Faced.

2. Thickness: Full depth of metal stud cavity unless indicated otherwise.
3. Adhesive or Sealing Tape: Product provided or recommended by manufacturer with demonstrated capability to bond foil-faced vapor-retarder membrane securely to substrates indicated.
4. Locations:

a. Exterior stud framed assemblies.
b. As indicated on Drawings.

2.9 GLASS-FIBER BOARD INSULATION (GLASS MINERAL FIBER SEMI-RIGID INSULATION)

A. Performance Requirements:

1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
3. Nominal Density: 3 lb/cu. ft. (48 kg/cu. m).
4. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
5. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width unless installer provides certification.

B. Glass-Fiber Board Insulation, Unfaced (GFB-U): ASTM C612, Type IA; unfaced, passing ASTM E136 for combustion characteristics.

1. Manufacturers:

a. CertainTeed Corporation; CertaPRO Commercial Board 300.
b. Johns Manville; a Berkshire Hathaway company; Insul-SHIELD 300.
c. Knauf Insulation; Insulation Board with Ecose Technology.
d. Owens Corning; 703.

2. Thickness: As indicated on Drawings but not less than 2-inches (50 mm).

C. Glass-Fiber Board Insulation, Faced (GFB-F): ASTM C612, Type IA; faced on one side with foil-scrim-kraft or foil-scrim-polyethylene vapor retarder.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; CertaPRO® Commercial Board 300.
b. Johns Manville; a Berkshire Hathaway company; Insul-SHIELD 300.
c. Knauf Insulation; Insulation Board with Ecose Technology.
d. Owens Corning; 703.

2. Thickness: As indicated on Drawings but not less than 2-inches (50 mm).

2.10 MINERAL-WOOL BLANKET INSULATION

A. Performance Requirements:

1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width unless installer provides certification.

B. Mineral-Wool Blanket Insulation, Unfaced (MW-U): ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

1. Basis-of-Design Product: ROCKWOOL (Roxul, Inc.); Comfortbatt.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. ROCKWOOL (Roxul, Inc.).
c. Thermafiber, Inc.; an Owens Corning company.

3. Thickness: Full depth of metal stud cavity unless indicated otherwise.
4. Locations:

a. Exterior stud framed assemblies.

b. As indicated on Drawings.

C. Mineral-Wool Blanket Insulation, Reinforced-Foil Faced (MW-F): ASTM C665, Type III (reflective faced); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Thermafiber, Inc.; an Owens Corning company.

2. Thickness: Full depth of metal stud cavity unless indicated otherwise.
3. Locations:

a. Exterior stud framed assemblies.
b. As indicated on Drawings.

2.11 MINERAL-WOOL BOARD INSULATION (MINERAL WOOL SEMI-RIGID INSULATION)

A. Performance Requirements:

1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
3. Labeling: Provide identification mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width unless installer provides certification.

B. Mineral-Wool Board Insulation, Unfaced (MWB-U): ASTM C612, Type IVA; passing ASTM E136 for combustion characteristics.

1. Basis-of-Design Product: ROCKWOOL (Roxul, Inc.); ROCKBOARD 40.
2. Manufacturers:

a. Johns Manville; a Berkshire Hathaway company.
b. ROCKWOOL (Roxul, Inc.)
c. Thermafiber, Inc.; an Owens Corning company.

3. Nominal Density: 4 lb/cu. ft. (64 kg/cu. m).
4. Thermal Resistivity: 4.2 deg F x h x sq. ft./Btu x in. at 75 deg F (0.72 m² x K/W at 24 deg C).
5. Locations:

a. Locations other than exterior cavity wall and rainscreen applications.
b. As indicated on Drawings.

C. Mineral-Wool Board, Unfaced (MWB-UEC) - Closed Joint Cladding Assemblies: ASTM C612, Type IVB; passing ASTM E136 for combustion characteristics.

1. Basis-of-Design Product: ROCKWOOL (Roxul, Inc.); Cavityrock.
2. Manufacturers:

a. Johns Manville; a Berkshire Hathaway company.
b. ROCKWOOL (Roxul, Inc.)
c. Thermafiber, Inc.; an Owens Corning company.

3. Monolithic Nominal Density - Thicknesses up to 2 Inches: Greater than 4.3 lb/cu. ft. (69 kg/cu. m).
4. Dual Nominal Density - Thicknesses greater than 2 Inches:

a. Inner Layer: 3.8 lb/cu. ft. (61 kg/cu. m).
b. Outer Layer: 6.24 lb/cu. ft. (100 kg/cu. m).

5. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (0.76 m² x K/W at 24 deg C).
6. Locations:
    a. Exterior cavity wall and rainscreen applications, closed joints.

D. Mineral-Wool Board, Faced (MWB-FEC) - Open Joint Cladding Assemblies: ASTM C612, Type IVB; passing ASTM E136 for combustion characteristics, black mineral fleece facing.

1. Basis-of-Design Product: ROCKWOOL (Roxul, Inc.); Cavityrock Black.
2. Manufacturers:
    a. Johns Manville; a Berkshire Hathaway company.
    b. ROCKWOOL (Roxul, Inc.)
    c. Thermafiber, Inc.; an Owens Corning company.
3. Monolithic Nominal Density - Thicknesses up to 2 Inches: Greater than 4.3 lb/cu. ft. (69 kg/cu. m).
4. Dual Nominal Density - Thicknesses greater than 2 Inches:
    a. Inner Layer: 3.8 lb/cu. ft. (61 kg/cu. m).
    b. Outer Layer: 6.24 lb/cu. ft. (100 kg/cu. m).
5. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (0.76 m² x K/W at 24 deg C).
6. Locations:
    a. Exterior cavity wall and rainscreen applications, open joints.

E. Mineral-Wool Board, Faced (MWB-FCW): ASTM C612, Type IVA; passing ASTM E136 for combustion characteristics, reinforced foil facing.

1. Basis-of-Design Product: ROCKWOOL (Roxul, Inc.); CURTAINROCK 40 or CURTAINROCK 80, as recommended by manufacturer for project specific installation requirements.
2. Manufacturers:
    a. Johns Manville; a Berkshire Hathaway company.
    b. ROCKWOOL (Roxul, Inc.)
    c. Thermafiber, Inc.; an Owens Corning company.
3. Nominal Density: Not less than 4 lb/cu. ft. (64 kg/cu. m).
4. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (0.72 m² x K/W at 24 deg C).
5. Locations:
    a. Curtain wall applications.

2.12 THIN PROFILE, HIGH THERMAL BLANKET INSULATION

A. Performance Requirements:

1. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 5 when tested in accordance with ASTM E84.

B. Silicon Aerogel Insulation: Unfaced, reinforced silicon aerogel insulation blankets.

1. Basis of Design: Dow; DOWSIL HP-1000 Building Insulation Blanket.
2. Thickness: As indicated on Drawings but not less than thickness required for an R-19.

2.13 LOOSE-FILL INSULATION

A. Performance Requirements:

1. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 5 when tested in accordance with ASTM E84.

B. Glass-Fiber Loose-Fill Insulation (GF-LF): ASTM C764, Type I for pneumatic application.

1. Manufacturers:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.

2.14 SPRAY-APPLIED THERMAL INSULATION

A. Performance Requirements:

1. Flame-Spread Index: Not more than zero when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.
3. Thermal Conductivity: 4.00/inch R-value (0.25 K-factor) in accordance with ASTM C518.
4. Noise Reduction Coefficient (NRC): 0.75 at 1 inch (25 mm); 0.95 at 2 inches (50 mm) in accordance with ASTM C423 and ISO 354.
5. Bond Strength: Minimum 43-lbf/sq. ft. (2.05-kPa) cohesive and adhesive strength based on field testing in accordance with ASTM E736.
6. Dry Density: 2.2 lb/cu. ft. (36.7 kg/cu. m) in accordance with ASTM D1622/D1622M.
7. Air Erosion: Maximum weight loss of 0.0 oz./sq. ft. (0 g/sq. m) in 24 hours in accordance with ASTM E859.
8. Fungus and Bacterial Resistance: No growth in accordance with MIL STD810F.

B. Self-Supported, Spray-Applied Glass Fiber Insulation (GF-SA): Type 902 bio-soluble white fiberglass conforming to CAN/ULC S102-10 and ASTM E136 and sprayed using manufacturer's liquid water-based bonding adhesive. Does not contain asbestos, crystalline silica, or combustible fibers. Noncombustible in accordance with ASTM E136.

1. Basis-of-Design Product: Monoglass Inc.: Sonoglass Spray-On Insulation, grey color.
2. Application Thickness: As indicated on Drawings but not less than 5 inches (125 mm) before tamping.

C. Substrate Primers: For spray-applied insulation, use manufacturer-approved, spray-applied, stain-blocking primers.

D. Spray-Applied Insulation Adhesive: Manufacturer's standard water-based, spray-applied adhesive for mixing with fibers at point of discharge during spray application of thermal insulation and for final topcoat of sprayed thermal insulation.

E. Spray-Applied Insulation Paint Coating:

1. Refer to Division 9 Section Painting for interior painting requirements.

F. Spray-Applied Insulation Sealer: Spray-applied, water-soluble, liquid-copoly emulsion.

1. Basis-of-Design Product: Monoglass Inc.; InsulSeal.

a. Tint Color: Gray, unless indicated otherwise.

2. Locations:

a. Installations exposed to view in finished construction.

b. Installation in crawl spaces.

3. Acoustical Installations: Insulation sealer thickness shall not reduce the acoustical performance of the underlying insulation.

2.15 POLYETHYLENE VAPOR-RETARDER MEMBRANE

A. Performance Requirements:

1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
3. Vapor Permeance: Maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).

B. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim.

C. Manufacturers: following:

1. Raven Industries; Dura-Skrim 2FR.
2. Reef Industries, Inc., Griffolyn Type T-55 FR.

D. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

1. Manufacturers and Products:

a. Raven Industries; Butyl Seal Tape (TP2BR) and Vapor Bond Tape (TVB4).
b. Reef Industries, Inc., Griffolyn Division; Fab Tape and Griff Tape FR.

E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

2.16 INSULATION FASTENERS

A. Power-Driven, Thermal Break Insulation Fasteners: High density polyethylene washer with heat-treated carbon steel pin, zinc plated; capable of holding insulation of specified thickness securely in position with pin type and minimum penetration recommended by manufacturer.

1. Basis-of-Design Product:Ramset I-F Insulation Fastening System, IFS (Steel) and IFC (Concrete or CMU)

2.17 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to which thermal insulation will be applied for compliance with requirements and other conditions affecting performance.

Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed unless installer provides certification.

D. For dual density products, install insulation with manufacturer's "THIS SIDE OUT" label exposed after insulation is installed.

E. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

F. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.4 INSTALLATION OF EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive in accordance with manufacturer's written instructions.

1. If not otherwise indicated at foundations and slabs, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units in accordance with manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

C. Seal joints between insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are placed. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

3.5 INSTALLATION OF MORTAR-FACED, EXTRUDED POLYSTYRENE FOAM PLASTIC BOARD

A. Install mortar-faced board insulation loosely laid, according to manufacturer's written instructions, with tongue-and-groove joints nested. Stagger end joints of adjoining rows and abut insulation.

3.6 INSTALLATION OF MINERAL FIBER BLANKETS AND BOARD INSULATION ON CONCRETE CONSTRUCTION

A. Butt panels together for tight fit.

B. Anchor Installation: Install insulation on concrete substrates by Power-Driven, Thermal Break Insulation Fasteners:

1. Space anchors in accordance with insulation manufacturer's written instructions for insulation type, thickness, and application.

C. Adhered insulation anchors are not allowed.

3.7 INSTALLATION OF EXTERIOR CAVITY-WALL INSULATION

A. Mineral-Wool Board Insulation: Install insulation fasteners 4 inches (100 mm) from each corner of board insulation, at center of board, and as recommended by manufacturer.

1. Fit courses of insulation between masonry wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

B. Adhered insulation anchors are not allowed.

3.8 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

a. For partitions with gypsum board on only one side, apply adhesive to backside of gypsum board and press insulation in place to form bond and prevent insulation from sagging within cavity.

3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings and seal each continuous area of insulation to ensure airtight installation.

a. Set units with facing placed as indicated on Drawings.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

2. Spray Polyurethane Insulation: Apply in accordance with manufacturer's written instructions.

3.9 INSTALLATION OF LOOSE-FILL INSULATION

A. Loose-Fill Insulation: Apply in accordance with ASTM C1015 and manufacturer's written instructions.

1. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

3.10 INSTALLATION OF SPRAY-APPLIED INSULATION

A. Spray-Applied Glass Fiber Insulation: Apply spray-applied glass-fiber insulation according to manufacturer's written instructions and using powered spray equipment that introduces water-based adhesive to fibers as they discharge from the spray nozzle, to produce a uniform thickness, free of starved spots or other evidence of thin application or of application patterns. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in installation areas is completed, and other items not indicated to receive insulation are masked.

1. Primer: Prepare and apply primer to gypsum panels and other prepared substrates to receive sprayed thermal insulation.
2. Place insulation in full thickness over the entire area of each substrate to be protected.

a. Spray-apply insulation materials to maximum extent possible. Complete coverage by trowel application or other placement method recommended in writing by manufacturer.
b. Maintain profile of substrates except fill voids between members, including voids formed by fluted decks above beams and similar voids.

3. Immediately remove droppings and overspray to prevent damage in accordance with manufacturer's written instructions.
4. Board- or spray-tamp surface of spray-applied thermal insulation to provide an even texture and apply coating of adhesive to provide a sound surface.

3.11 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Install multiple membrane sheets to form continuously sealed vapor retarder at interior face of framing; maintain membrane integrity throughout construction phase.

1. Place vapor retarders on side of construction indicated on Drawings.

B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

1. Before installing vapor-retarder, apply sealing tape to flanges of metal framing, including top and bottom runner tracks, metal studs, and framing around wall openings.
2. Pull vapor-retarder taut and press into sealing tape and firmly roll to enhance adhesion.
3. Locate perimeter terminations over framing members or other solid substrates. Include sheet metal flanges or extensions to prevent attachment to sprayed fireproofing directly.
4. Seal top, sides, and bottom edges to building structure with seaming tape, seal edges at perimeter of wall openings.

C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders extending 6 in (150 mm) beyond damaged areas in each direction.

3.12 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction in accordance with curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips, brackets, pins and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place.
2. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
3. Install insulation to fit snugly without bowing.
4. Install insulation mullion covers, minimum 8 in (200 mm) width centered over horizontal and vertical aluminum frames within spandrel.

3.13 FIELD QUALITY CONTROL FOR SPRAY-APPLIED THERMAL INSULATION

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Owner's Testing Agency Field Service for Spray-Applied Thermal Insulation: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

1. Tests: As determined by Owner testing agency for adhesion/cohesion, density and thickness.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.14 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Remove sprayed thermal insulation from surfaces not required to be insulated.

1. Broom-clean work areas affected by the Work of this Section.

D. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 072423
DIRECT APPLIED EXTERIOR FINISH SYSTEM (DEFS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes direct-applied exterior finish system (DEFS) and supplementary items necessary to complete the work required for its installation as a textured finish system.

1. DEFS for gypsum sheathing or cementitious backer units at soffits.
2. DEFS for concrete masonry units (CMU).
3. DEFS for concrete.

B. Related Requirements:

1. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

1.2 DEFINITIONS:

A. DEFS: Direct-applied exterior finish system.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: 24-inch- (600-mm-) square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work.

1. Include samples to verify color selected.
2. Include a typical control joint filled with sealant of color selected.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1. DEFS complies with requirements.
2. DEFS substrate is acceptable to DEFS manufacturer.
3. Accessory products installed with DEFS, including joint sealants, flashing, water-resistant barriers, and other accessories whether or not furnished by DEFS manufacturer are acceptable to DEFS manufacturer.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

C. Field quality-control reports.

D. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For DEFS to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Maintenance Kit: Furnish maintenance kit to Owner to include the following:

1. Printed Maintenance Instructions.
2. Base Coat Material: 1 gallon (3.8 L)
3. Finish Coat Material: 1 gallon (3.8 L) for each color installed, from same batch as installed.
4. Reinforcing Mesh: 20 sf (1.8 sq m).

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.8 MOCKUPS

A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.

   a. Demonstrate the proposed range of aesthetic effects and workmanship.
   b. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
   c. Protect accepted mock-up from the elements with weather-resistant membrane.

4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.

5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.9 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit DEFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.12 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.13 WARRANTY

A. Manufacturer’s Warranty: Furnish manufacturer’s written material and labor warranty signed by an authorized representative using manufacturer’s standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. “Defects” is defined to include but not limited to deterioration or failure to perform as required and water penetration through the coating.

1. Failures include, but are not limited to, the following:

a. Deterioration of DEFS finishes and other DEFS materials beyond normal weathering.

1) Including, but not limited to, peeling, cracking, delamination, flaking or similar failures.

2. Warranty coverage includes the following DEFS components:

a. DEFS finish, including base coats, finish coats, and reinforcing mesh.

3. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion.

a. Inspection: The Manufacturer shall provide final inspection at the completion of application of the System including all contiguous sealant joints.
b. Certificate: Submit Certificate of Warranty from manufacturer and installer evidencing compliance with these specifications.

B. Installer’s Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer’s standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 5 years from date of Substantial Completion

C. Repair and replace defective work under the terms of the warranty at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Dryvit Systems, Inc.
2. Omega Products International, Inc.
3. Sika Corp.; Parex
4. Sto Corp.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Cementitious Backer Units/Gypsum Sheathing at Soffits: Sika Corp.; Parex ACF for Soffits.
2. CMU or Concrete at Walls or Columns: Sika Corp.; Parex ACF for Concrete and Masonry.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Compatibility: Provide base and finish coat materials, and accessories that are compatible with one another and approved for use by system manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

2.4 DEFS MATERIALS

A. Sheathing Joint Treatment Materials: System manufacturer standard detail mesh and base coat.

B. Barrier Flashing/Transition Membrane: DEFS manufacturer's recommended standard or product recommended in writing by DEFS manufacturer. One of the following:

1. Flexible Membrane Flashing: Self-adhering, self-sealing rubberized asphalt and polyethylene film composite sheet or tape and primer.

2. Fluid Applied Membrane Flashing: Flexible, water-based polymer coating with embedded mesh reinforcement.

C. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other DEFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) according to ASTM E2098/E2098M and the following:

1. Reinforcing Mesh: Not less than 4.5 oz./sq. yd. (153 g/sq. m) and as recommended by DEFS manufacturer.

D. Waterproofing Base Coat: DEFS manufacturer's recommended standard factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers.

1. Basis of Design: Sika Corp.; Parex WeatherDry.

E. Primer: DEFS manufacturer's recommended standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

F. Finish Coat: DEFS manufacturer's standard factory blended, 100% acrylic polymer based coating with enhanced mildew resistance or siliconized acrylic-based coating complying with the following:

1. Basis of Design: Sika Corp.; Parex DPR Optimum Finish.

a. Color and Texture Selections: As scheduled or as indicated in Design Selections.

G. Water: Potable.

H. Soffit Vent: Extruded aluminum soffit vent 2 in (50 mm) wide by continuous. Locate where indicated on drawings.

I. Control Joint: One-piece vinyl trim formed with V-shaped slot, with removable strip covering slot opening. Vinyl Corp; DEFS Control Joint, or equivalent as accepted by Architect; thickness to match subtrate board.

2.5 ELASTOMERIC SEALANTS

A. Elastomeric Sealant Products: Provide DEFS manufacturer's listed and recommended chemically curing, low-modulus silicone sealant that is compatible with joint fillers, joint substrates, and other related materials.

1. Comply with requirements for products and testing indicated in "EIMA Guide for Use of Sealants with Exterior Insulation and Finish Systems, Class PB".
2. Comply with requirements in Division 07 Section "Joint Sealants" for low-modulus silicone sealant products.

B. Sealant Color: As scheduled or as indicated in Design Selections.

2.6 MIXING

A. General: Comply with DEFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by DEFS manufacturer. Mix materials in clean containers. Use materials within time period specified by DEFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Comply with applicable provisions of ASTM C1397, ASTM E2511, and DEFS manufacturer's written instructions for installation of DEFS as applicable to each type of substrate.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Protect contiguous work from moisture deterioration and soiling resulting from application of systems. Provide temporary covering and other protection needed to prevent spattering of exterior finish coatings on other work.

C. Protect system, substrates, and wall construction behind them from inclement weather during installation. Prevent infiltration of moisture behind system and deterioration of substrates.

D. Prepare and clean substrates to comply with system manufacturer's requirements to obtain optimum bond between substrate and base coat/finish system.

3.4 INSTALLATION OVER GYPSUM SHEATHING OR CEMENTITIOUS BACKER UNITS

A. General: Comply with manufacturer's current published instructions for installation of system as applicable to type of substrate indicated.

B. Sheathing Joints: Pre-fill panel-to-panel and corner joints with base coat material, cover with fabric reinforcing, and then level the joint. Joint shall be wrinkle-free with fabric continuous or lapped at corners and lapped or otherwise treated at joints to comply with system manufacturer's requirements. Completely embed fabric, so that reinforcing fabric pattern is not visible.

C. Control Joints: Install control joints at locations indicated on Drawings, but not to exceed more than 30 feet (9 m) in either direction for uninterrupted straight planes of ceilings.

D. Waterproofing Base Coat: Apply base coat materials with fully embedded mesh over substrate in thickness required by system manufacturer to a uniform, smooth and flat surface, and allow it to dry.

E. Primer: Apply primer evenly with brush, roller or spray equipment over clean, dry base coat and allow to dry thoroughly before applying finish.

F. Finish Coat: Apply full-thickness coverage over dry base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Do not extend finish coat over surfaces where sealant is applied.

3.5 INSTALLATION OVER CONCRETE MASONRY UNITS

A. General: Comply with manufacturer's current published instructions for installation of system as applicable to type of substrate indicated.

B. Waterproofing Base Coat: Apply base coat materials with fully embedded mesh over substrate in thickness required by system manufacturer to a uniform, smooth and flat surface, and allow it to dry.

C. Primer: Apply primer evenly with brush, roller or spray equipment over clean, dry base coat and allow to dry thoroughly before applying finish.

D. Finish Coat: Apply full-thickness coverage over dry base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Do not extend finish coat over surfaces where sealant is applied.

3.6 INSTALLATION OVER CONCRETE

A. General: Comply with manufacturer's current published instructions for installation of system as applicable to type of substrate indicated.

B. Waterproofing Base Coat: Apply base coat materials with fully embedded mesh over substrate in thickness required by system manufacturer to a uniform, smooth and flat surface, and allow it to dry.

C. Primer: Apply primer evenly with brush, roller or spray equipment over clean, dry base coat and allow to dry thoroughly before applying finish.

D. Finish Coat: Apply full-thickness coverage over dry base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Do not extend finish coat over surfaces where sealant is applied.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

1. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.8 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive DEFS coatings.

B. Provide final protection and maintain conditions, in a manner acceptable to Installer and DEFS manufacturer that ensure system is without damage or deterioration at the time of Substantial Completion.

3.9 FINISH SCHEDULE

A. Color and Texture / Sealant Color: Match existing.

B. Color and Texture/ Sealant Color: Match Architect's sample.

C. Color and Texture / Sealant Color: As selected by Architect from full range of manufacturer's standards.

D. DEFS01:

1. Manufacturer:
2. Texture:
3. Color:
4. Sealant Color

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 072617
BELOW SLAB VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Below slab vapor retarders and supplementary items necessary for installation.

B. Adhered and Specialty Floor Finishes at Slab-on-Grade Areas: Refer to floor finish section(s) for concrete moisture barrier treatment at adhered floorings, thin-set terrazzo and wood flooring systems.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, construction details, installation instructions, and recommendations for maintenance.
2. Include manufacturer's standard drawing details for laps, openings, penetrations, corners, and other conditions applicable to this project.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

C. Warranties:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Mock-Ups: Prior to beginning Work of this Section, install minimum 150 sf (14 sq m) mock-up of below slab vapor retarder using materials indicated for the completed Work; incorporating subgrade construction, sealing at penetrations, and seaming to demonstrate installation of below slab vapor retarder system. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are

specifically accepted by Architect in writing. Apply mock-ups to set quality standards for materials and execution.

1. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.6 PROJECT CONDITIONS

A. Ambient Conditions: Install below slab vapor retarder within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer. Protect substrates from environmental conditions that affect performance. Do not apply to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into Work include but are not limited to those listed.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Material Compatibility: Provide materials that are compatible with one another under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

2.4 BELOW SLAB VAPOR RETARDERS

A. Vapor Retarder for Typical Concrete Slab-on-Grade Conditions:

1. Product Quality Standard: ASTM E 1745, Class A, except water vapor permeance property shall not exceed 0.03 perms according to ASTM E 96, Method B.
2. Description: Prefabricated, flexible, lightweight material manufactured from raw or virgin polyethylene or polyolefin resins (post-consumer, recycled resins are not permitted); not less than 15 mil (0.4 mm) thick.
3. Manufacturers and Products:

   a. Barrier-Bac; VB-350
   b. Fortifiber Building Product Systems; Moistop Ultra 15
   c. W. R. Meadows, Inc.; Perminator, 15-mil
   d. Viaflex; VaporBlock 15
   e. Reef Industries, Inc.; Griffolyn 15-mil Green
   f. Stego Industries LLC; Stego Wrap, 15-mil

B. Vapor Retarder for Structured Concrete Slab Conditions:

1. Product Quality Standard: ASTM E 1745, Class A, except water vapor permeance property shall not exceed 0.03 perms according to ASTM E 96, Method B.
2. Description: Prefabricated, flexible or semi-flexible, material manufactured of one of following compositions; with one face suited for integral bonding with concrete; not less than 20 mil (0.05 mm) thick.

   a. Raw or virgin polyethylene or polyolefin resins (post-consumer, recycled resins are not permitted).
   b. Multiple ply board composed of a proprietary core with bituminous impregnated material and glass-mat liners, with polyethylene facers.

3. Manufacturers and Products:

   a. Barrier-Bac; VBC-350
   b. Grace Construction Products; Florprufe 120
   c. W. R. Meadows, Inc.; Premoulded Membrane Vapor Seal with Plasmatic Core (PMCP), with felt face toward concrete
   d. Polyguard Products, Inc.; Underseal
   e. Stego Industries LLC; Stego Wrap, 15-mil

2.5 ACCESSORIES

A. Barrier Seaming and Sealing Tape: Manufacturer's standard one-sided or two-sided pressure-sensitive tape of type, material and size for sealing membrane joints and for sealing membrane to other adjacent structures; provided by vapor retarder manufacturer.

B. Penetration Accessories: Manufacturer's standard pre-molded products or mastic for sealing penetrations; provided by vapor retarder manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine subgrade and foundation surfaces to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:

1. ASTM E 1643, except place vapor retarder on top of granular fill.
2. Respective manufacturer's installation written instructions.
3. Accepted submittals.
4. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and Project specifications for subgrade preparation. Subgrade surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work. Provide smooth, level, and properly compacted and moisture conditioned subgrade in accordance with Geotechnical Engineer's recommendations.

B. Ensure that subgrade is smooth and even without sharp or protruding objects that might rip, tear, or puncture vapor retarder membrane.

3.4 BELOW SLAB VAPOR RETARDER INSTALLATION

A. Install multiple sheets to form continuously sealed below slab vapor retarder over properly prepared subgrade prior to concrete slab reinforcing installation.

1. Place vapor retarder membrane in widest width possible over subgrade with longest dimension parallel with direction of concrete placement with proper face toward concrete; pull taut to eliminate fishmouths, wrinkles, buckles, and kinks.
2. Properly dry and clean mating surfaces of vapor retarder membrane prior to application of seaming tape.
3. Overlap sides and ends of vapor retarder membrane not less than 6 in (150 mm) and apply seaming tape.
4. Ensure vapor retarder membrane is continuous from edge to edge of concrete slab.

a. Perimeter Seal: Seal vapor retarder to perimeter wall or footing/grade beam with tape per manufacturer recommended installation instructions.

5. Cut vapor retarder membrane carefully around penetrations and seal with either premolded accessories, or on-site collar fabrications using seaming tape or mastic; if field fabricated, comply with manufacturer's recommended details.
6. Repair rips, tears, or punctures with seaming tape, or by cutting out damaged areas and patching with new vapor retarder membrane, overlapping damaged area minimum 6 in (150 mm) in each direction and apply seaming tape.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Including but not limited to the following:

a. Prior to beginning concrete slab reinforcing installation, inspect vapor retarder membrane for rips, tears, and punctures.
b. Prior to concrete placement work, inspect concrete installer's tools and notify Contractor to have tools with spikes or other sharp surfaces that could inflict intentional or unintentional damage on the installed vapor retarder membrane removed from work area.
c. Immediately prior to concrete placement work, inspect vapor retarder membrane for rips, tears, and punctures, inspect penetrations at columns and mechanical and electrical piping.
d. Continuously inspect concrete placement work, watching for damage to vapor retarder membrane.
e. Periodically inspect portions of slab that were not placed (block-outs, voids, and leave-outs) for water infiltration of subgrade until concrete is subsequently placed.

2. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3. Prepare test and inspection reports.

3.6 PROTECTION

A. Protection during Concrete Work: Ensure vapor retarder membrane will be without damage or deterioration during in-place fabrication of concrete slab reinforcing and subsequent placement of concrete.

1. Prevent vehicles from driving over vapor retarder membrane once it has been placed.

2. Prevent wood or steel stakes from penetrating vapor retarder membrane.
3. At locations where portions of slab are not placed (block-outs, voids and leave-outs), provide protection to prevent water infiltration into void that would contaminate subgrade below vapor retarder membrane; maintain until concrete is subsequently placed.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 074213
FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Factory-formed metal wall panels and supplementary items necessary for installation.

B. Related Requirements:

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Division 01 Building Enclosure Commissioning Plan for Field Observations and Performance Testing.

1.2 DEFINITIONS

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, and supplementary items necessary for a complete weathertight wall system.

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include the following:

1. Show fabrication and installation layouts of metal wall panels.
2. Show details and locations of edge conditions, side-seam and end-lap joints, panel profiles, corners, anchorages, trim, flashings, closures, and terminations.
3. Show details for securing metal wall panel assembly, including layout of fasteners and other attachments.
4. Show details of wall panel penetrations.
5. Show details of connections to adjoining work.
6. Indicate where and how the system deviates from Contract Documents.
7. Shop drawings shall contain seal of a professional engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
8. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.
9. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.
10. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

C. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:

1. Wall panel assembly and attachments.
2. Girts and framing.
3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
4. Penetrations of wall panels by pipes and utilities.

D. Samples for Verification Purposes: For each type of exposed finish required, prepared on samples of size indicated below.

1. Metal Wall Panels: 12 in (300 mm) long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
2. Trim and Closures: 12 in (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: 12 in (300 mm) long samples for each type of accessory.
4. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2 in (12 mm) wide joints formed between two 6 in (150 mm) long strips of material matching the appearance of metal-faced composite wall panels adjacent to joint sealants.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for

specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.

C. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

D. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

E. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.8 MOCKUPS

A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.

4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.9 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

1.11 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturer’s written instructions and warranty requirements.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.12 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.13 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion

B. Installer's Warranty: Furnish installer written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

C. Factory Applied Finish Warranty for Fluoropolymer Finishes: Furnish manufacturer written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Coverage includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. American Building Components.

2. ATAS International, Inc.
3. Berridge Manufacturing Company.
4. Kalzip.
5. Kingspan.
6. CENTRIA Architectural Systems.
7. MBCI

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:

1. Live Load Deflection: Accommodate differential vertical deflection of floors:

a. Deflection: As indicated on Drawings.

2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:

a. Design Displacement: As indicated on Drawings.

D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

E. Deflection Limits: At design wind pressure.

1. Deflection of Panels: Limit panel deflection to no greater than L/180 of the span.

F. Structural-Test Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 or ASTM E 330 as follows:

1. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of the clear span.

G. Water Penetration under Static Pressure: Test in accordance with ASTM E 331 as follows:

1. No evidence of water penetration for the system when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sf (300 Pa).

H. Energy Performance:

1. Air Leakage: Test in accordance with ASTM E 283 as follows:

a. Air leakage for the system of not more than 0.06 cfm/sf (0.30 L/s/sm) at a minimum static-air-pressure differential of 6.24 lbf/sf (300 Pa) when tested in accordance with ASTM E 283.

I. Windborne-Debris-Impact-Resistance Performance: Comply with impact resistance testing requirements for Wind Zone.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, and other detrimental effects.

K. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 METAL WALL PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

1. Surface: Smooth, flat.
2. Exterior Finish: Fluoropolymer finish.
3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mils (0.013 mm).

B. Aluminum Sheet: Coil-coated sheet, ASTM B209 (ASTM B209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Surface: Smooth, flat.
2. Exterior Finish: Fluoropolymer finish.

2.5 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Corrugated-Profile, Exposed-Fastener Metal Wall Panels: Formed with alternating curved ribs spaced at 2.67 in (68 mm) on center across width of panel.

1. Basis of Design: CENTRIA; Econolap
2. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer; 22 gage, 0.034 in (0.8 mm) nominal minimum thickness.
3. Panel Coverage: 34-2/3 in (880 mm).
4. Panel Height: 3/4 in (19 mm).

C. Box-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.

1. Basis of Design: CENTRIA; BR5-36
2. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer; 22 gage, 0.034 in (0.8 mm) nominal minimum thickness.
3. Panel Coverage: 36 in (914 mm).
4. Rib Spacing: 7.2 in (183 mm) on center.
5. Panel Height: 1-1/2 in (38 mm).

2.6 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and flat panel between panel edges; with flush joint between panels.

1. Basis of Design: CENTRIA; IW 10A
2. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer; 22 gage, 0.034 in (0.8 mm) nominal minimum thickness.
3. Panel Coverage: 12 in (300 mm).
4. Panel Height: 1-1/2 in (38 mm).

C. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.

1. Basis of Design: CENTRIA; IW 14A
2. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer; 22 gage, 0.034 in (0.8 mm) nominal minimum thickness.
3. Panel Coverage: 12 in (300 mm).
4. Panel Height: 1-1/2 in (38 mm).

D. Reveal-Joint, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and flat pan between panel edges; with narrow reveal joint between panels.

1. Basis of Design: CENTRIA; IW-40A
2. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer; 22 gage, 0.034 in (0.8 mm) nominal minimum thickness.
3. Panel Coverage: 11 in (279 mm).
4. Reveal Joint: 1 in (25 mm) wide.
5. Panel Height: 1-1/2 in (38 mm).

2.7 CONCEALED-FASTENER, METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Soffit Panels: Formed with vertical panel edges and flat panel between panel edges; with flush joint between panels.

1. Basis of Design: CENTRIA; IW 10A

2. Material: Zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet, standard of manufacturer; 22 gage, 0.034 in (0.8 mm) nominal minimum thickness.
3. Panel Coverage: 12 in (300 mm).
4. Panel Height: 1-1/2 in (38 mm).

2.8 SUBFRAMING AND PANEL ACCESSORIES

A. Metal Subframing and Furring: Provide manufacturer standard sections as required for support and alignment of metal panel system.

1. Sub-girts, Zee Clips, Base or Sill Angles or Channels: Manufacturers standard C, U or Z-shaped sections, type as recommended by panel manufacturer.

a. Metallic Coated Steel Sheet: ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation.

1) Thickness: Not less than 0.063 inch, 16 gauge nominal thickness.

b. Aluminum Sheet: Clear anodized sheet, ASTM B209 (ASTM B209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1) Thickness: Not less than 0.051 inch, 16 gage nominal thickness.

c. Aluminum Extrusions: ASTM B 221 / B 221M, alloy and temper recommended by panel manufacturer for type of use and finish indicated.

B. Composite Metal Hybrid Subframing System: Subframing system consisting of fire retardant polyester resin girts reinforced with integral continuous metal inserts and fasteners designed to integrate cavity insulation and eliminate thermal bridging of subframing and fasteners.

1. Basis of Design: Advanced Architectural Products; SMARTci System GreenGirt CMH Sub-Framing, Z-Girt size as required for insulation thickness indicated.

C. Fasteners for Sub-framing and Furring: Self-tapping screws, bolts, nuts, and other suitable fasteners, Series 300 stainless steel of size, corrosion resistance, holding power, and other properties required to comply with performance requirements.

1. Provide fasteners with EPDM or PVC sealing washers.

D. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures fabricated of same metal as metal wall panels.
2. Closure Strips: Closed-cell, expanded, cellular, rubber or cross-linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1 in (25 mm) thick, flexible closure strips; cut or pre-molded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

E. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

F. Panel Fasteners: Self-tapping screws, bolts, nuts, and other suitable fasteners, Series 300 stainless steel of size, corrosion resistance, holding power, and other properties required to comply with performance requirements. Provide exposed fasteners with heads matching color of metal panels factory-applied coating.

1. Provide fasteners with EPDM or PVC sealing washers.

G. Panel Sealants: Provide the following as recommended by metal wall panel assembly manufacturer for installation indicated.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 in (12 mm) wide and 1/8 in (3 mm) thick.
2. Elastomeric Joint Sealant: ASTM C 920; elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal exposed joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for concealed hooked-type expansion joints with limited movement.

H. Self-Adhering, High-Temperature Rubberized Asphalt Flashing: Minimum 30 mils to 40 mils (0.76 mm to 1.00 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (-6.7 deg C).
3. Manufacturers and Products:

a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
b. GCP Applied Technologies; Ultra.
c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

I. Barrier Flashing Tape: Air-barrier manufacturer standard adhesive and pressure-sensitive adhesive tape. Refer to Division 07 Section "Air and Water Barriers".

J. Maintenance Equipment Anchors: As specified in Division 11 Section Building Maintenance Equipment.

2.9 SECONDARY STEEL SUPPORT STRUCTURE

A. Comply with Division 05 Section Structural Steel Framing.

1. Refer to Structural Documents for secondary steel support substructure.

B. Support Structure Finish:

1. Zinc Coated Finish: Zinc coated by hot-dip process according to ASTM A123/A123M, after fabrication, or ASTM A153/A153M.

a. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.

2. Shop-Applied or Field-Applied Coatings: Refer to Division 9 Section High Performance Coatings applied to all secondary steel support structure.

2.10 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.11 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

D. Finish Selections: As scheduled or indicated in Design Selections.

2.12 STEEL FINISHES

A. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers written instructions. Provide dry film thickness,

primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 621 and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 621 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

2.13 ALUMINUM FINISHES

A. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
3. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before installation.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors

which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Subframing and Supports: Install subframing, subgirts, base angles, closure channels, sills, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal composite material panel manufacturer's written recommendations.

3.4 ASSEMBLY INSTALLATION

A. General: Install metal wall panels according to manufacturer written instructions in orientation, sizes, and locations indicated on Drawings.

B. Wall Panels: Install wall panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal wall panels.
2. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
3. Install screw fasteners in predrilled holes.

   a. Air and Water Barrier: Install a strip of barrier flashing tape behind through-wall attachments that penetrate air and water barrier. Seal all penetrations with weather barrier sealant.

4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal wall panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
8. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
9. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

C. Fasteners: Use stainless-steel fasteners.

D. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

E. Attachment Assembly, General: Install attachment assembly required to support metal wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
2. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.

F. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
7. At panel splices, nest panels with minimum 6 in (150 mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

3.5 METAL SOFFIT PANEL INSTALLATION

A. In addition to complying with requirements in "Wall Panel Assembly Installation" Article, install metal soffit panels to comply with requirements in this article.

B. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.

1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

C. Metal Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

a. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in weathertight and weather-resistant performance.
    a. Install escutcheons for pipe and conduit penetrating exterior walls.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft (3 m) with no joints allowed within 24 in (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and weathertight, form expansion joints of intermeshing hooked flanges, not less than 1 in (25 mm) deep, filled with mastic sealant (concealed within joints).

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
    1. Manufacturer Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.
    1. Refer to Division 01 Section Field Test for Air and Water Leakage.
    2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.
    1. Correction of Deficiencies:
        a. Materials and installation will be considered defective if they do not meet specified requirements.
        b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
        c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
    2. Prepare test and inspection reports.

3.8 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.9 ARCHITECTURAL METAL FINISH SCHEDULE

A. Finish Color: Match Existing.

B. Finish Color: Match Architect's sample.

C. Finish Color: As selected by Architect from manufacturer's standard colors.

D. Finish Color: As selected by Architect from manufacturer's custom colors.

E. Finish Color: AMFXX

1. Manufacturer:
2. Product Series:
3. Color Name and Number:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 075013
SINGLE-PLY MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Single-ply membrane roofing system and supplementary items necessary for installation.

1. Adhered polyvinyl chloride (PVC) roofing system.
2. Adhered polyvinyl chloride (PVC) roofing system, fleece or felt backing.
3. Adhered thermoplastic polyolefin (TPO) roofing system.
4. Adhered thermoplastic polyolefin (TPO) roofing system, fleece or felt backing.
5. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system.
6. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system, fleece or felt backing.
7. Adhered ethylene interpolymer (KEE) roofing system.
8. Adhered ethylene interpolymer (KEE) roofing system, fleece or felt backing.

B. Related Requirements:

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
2. Lightweight Insulating Concrete: Refer to Division 03 Section Lightweight Insulating Concrete for embedded insulation board.

1.2 ALLOWANCES

A. Allowance for Concrete Moisture Barrier/Vapor Retarder: Include allowance to provide Roofing Manufacturer's recommended concrete moisture barrier/vapor retarder for concrete substrates that do not comply with Roofing Manufacturer's concrete moisture content and testing requirements.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

B. Roof Edge Regions: Definitions from ANSI/SPRI ED-1 shall be applicable to this project.

C. PVC: Polyvinyl chloride.

D. PVC-KEE: Polyvinyl Chloride – Ketone Ethylene Ester copolymer blend.

E. TPO: Thermoplastic polyolefin.

F. EPDM: Ethylene-Propylene-Diene-Monomer.

G. KEE: Ethylene interpolymer.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

a. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Show base flashings and membrane terminations.
2. Show layout and thickness of flat insulation.
3. Show layout and thickness of tapered insulation, including slopes.
4. Show crickets and saddles, including slopes.
5. Show roof plan indicating orientation of membrane roofing and fastener spacing.
6. Show insulation and cover board fastening or adhesive patterns for corner, perimeter, and field-of-roof locations.
7. Show cold-applied adhesive pattern for insulation and cover board installation; typical pattern of a 100 square foot area.
8. Include project specific details for typical and non-typical conditions.

C. Samples for Verification Purposes: For the following products:

1. Roofing membrane, 12 in by 12 in (300 mm by 300 mm) square, of color specified, including side and end lap seam.
2. Flashing sheets.
3. Vapor retarder, 12 in by 12 in (300 mm by 300 mm) square.
4. Roof insulation and cover board.
5. Termination bars.
6. Fasteners of each type, length, and finish.
7. Walkways, of color required.
8. Roof paver, full sized, in each color and texture required.
9. Decorative stone, 10 lb (4.5 kg) in gradation and color indicated.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1. Decorative Stone or Pavers: Comply with applicable provisions of ANSI-SPRI RP-4.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with Performance Requirements.

a. Submit evidence of compliance with performance requirements.

2. Roofing manufacturer shall review and approve Shop Drawings in writing prior to submission.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

D. Concrete Roof Deck - Moisture Content Measurement: Submit recorded readings when requested.

1. Submit moisture content readings to roofing manufacturer.

E. Substrate Surface Temperature Readings at Cold Fluid-Applied Insulation Adhesive: Submit recorded readings when requested.

1. Submit surface temperature readings to roofing manufacturer.

F. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed or acceptable to manufacturer to install products.

C. Insurance Certification: Assist Owner in preparing and submitting roof installation acceptance certification as necessary in connection with fire and extended-coverage insurance on roofing and associated work.

D. Quality Standards:

1. Unless otherwise recommended by roofing manufacturer, provide roofing system in accordance with recommendations of the NRCA "Roofing and Waterproofing Manual" for roofing type indicated.
2. Comply with FMG System Loss Prevention Data Sheets 1-28 and 1-28S for design wind loads and wind uplift pressures on roofs for Windstorm Resistance Classification indicated.
3. Comply with FMG System Loss Prevention Data Sheet 1-29 for roof deck securement and above deck components for Windstorm Resistance Classification indicated.
4. Comply with FMG System Loss Prevention Data Sheet 1-49 for perimeter flashing for Windstorm Resistance Classification indicated.

1.8 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Participants:

   a. Architect.
   b. Contractor, including superintendent.
   c. Installer, including project manager and supervisor (superintendent).
   d. If requested, Manufacturer's qualified technical representative.
   e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review inspection and testing requirements.
   e. Review environmental conditions and procedures for coping with unfavorable conditions.
   f. Resolve deviations or differences between Contract Documents and the manufacturer’s specifications.
   g. Review deck substrate requirements for conditions and finishes, including flatness, presence of moisture, and fastening.
   h. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
   i. Review governing regulations and requirements for insurance and certificates if applicable.
   j. Review temporary protection requirements for roofing during and after installation.
   k. Review roof observation and repair procedures after roofing installation.

3. Record discussions, including decisions and agreements, and prepare report.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored material from direct sunlight.

   1. Discard and legally dispose of material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.12 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written "Total Roofing System" warranty signed by an authorized representative using manufacturer's standard form, without monetary limitation (NDL), agreeing to repair or replace components of roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.

1. Warranty Wind Speed: Minimum 90-mph Peak Gust Wind Speed.
2. Warranty includes roofing, flashings, adhesives, sealants, insulation, fastener systems, cover board, substrate board, roofing accessories and other components of roofing system.
3. Warranty includes lightweight insulating concrete integral with roofing system as specified in Division 03 Section Lightweight Insulating Concrete.
4. Warranty includes roof edge flashings integral with roofing system as specified in Division 07 Section Sheet Metal Flashing and Trim.
5. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 20 years from date of Substantial Completion.

B. Installer's Warranty: Furnish installer's written warranty signed by an authorized representative using installer's standard form agreeing to repair or replace components of roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.

1. Warranty includes roofing, flashings, adhesives, sealants, insulation, fastener systems, cover boards, substrate board, roofing accessories, and other components of roofing system.
2. Warranty includes lightweight insulating concrete integral with roofing system as specified in Division 03 Section Lightweight Insulating Concrete.
3. Warranty includes roof edge flashings integral with roofing system as specified in Division 07 Section Sheet Metal Flashing and Trim.
4. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and base flashings shall remain watertight.

1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Provide roofing system materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897. Contractor shall obtain required design data and identify requirements accommodated on submittal drawings.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.

D. FM Approvals' Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

1. Fire/Windstorm Classification - Field of Roof: Class 1A-90.
2. Fire/Windstorm Classification - Roof Perimeter / Corner: Class 1A-150 / Class 1A-225.
3. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34.

a. Rating: SH Severe Hail.
b. Rating: VSH Very Severe Hail.

E. Florida Product Approval / NOA Listing: Provide roofing system, base flashings, and component materials that comply with requirements in Florida Product Approval / Notice of Acceptance as part of a roofing system including but not limited to fire resistance, physical properties, pull-through resistance and wind and wind driven rain resistance in accordance with requirements of authorities having jurisdiction.

F. SPRI Wind Design Standard for Edge Systems: Provide edge systems tested in accordance with ANSI/SPRI/FM 4435/ES-1 Wind Test Design Standard for Edge Systems Used with Low Slope Roofing Systems and capable of resisting design pressures.

G. Energy Performance for Low Slope Roofs: Provide roofing system with Solar Reflectance Index calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

1. Initial SRI of not less than 82 or 3-Year Aged SRI of not less than 64.

H. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low and steep-slope roof products.

I. Energy Performance: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

J. Fire-Test-Response Characteristics: Provide roofing system materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: ASTM E 108, Class A, for application and roof slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

2.4 POLYVINYL CHLORIDE (PVC) ROOFING

A. PVC Membrane Roofing System: ASTM D 4434, Type II glass-fiber reinforced membrane.

1. Manufacturers and Products:

a. Carlisle SynTec, Inc.; Sure-Flex PVC FRS.
b. GAF; EverGuard PVC (Fiberglass Reinforced).
c. Johns Manville, Inc.; JM PVC FRS.
d. Sika Sarnafil Inc.; G410 PVC.

2. Membrane Thickness: 60 mils (1.5 mm), minimum.
3. Membrane Thickness: 80 mils (2.0 mm), minimum.
4. Exposed Face Color: White.
5. Exposed Face Color: As selected by Architect from manufacturer's standard colors.
6. Exposed Face Color: Custom color to be determined by Architect.

B. PVC Membrane Roofing System, Fleece or Felt Backed: ASTM D 4434, Type II glass-fiber reinforced, fleece or felt backed.

1. Manufacturers and Products:

a. Carlisle Syn Tec, Inc.; Sure-Flex PVC FRS FleeceBACK.
b. GAF; EverGuard PVC (Fiberglass Reinforced) Fleece-Back.
c. Johns Manville, Inc.; JM PVC FRS FB.
d. Sika Sarnafil Inc.; G410 PVC Feltback.

2. Membrane Thickness: 60 mils (1.5 mm), minimum.

a. Composite Thickness: 115 mils (2.8 mm), nominal.

3. Membrane Thickness: 80 mils (2.0 mm), minimum.

a. Composite Thickness: 135 mils (2.8 mm), nominal.

4. Exposed Face Color: White.
5. Exposed Face Color: As selected by Architect from manufacturer's standard colors.
6. Exposed Face Color: Custom color to be determined by Architect.

C. PVC KEE Membrane Roofing System: ASTM D 4434, Type II glass-fiber reinforced or Type III polyester fabric reinforced membrane.

1. Manufacturers and Products.

a. Carlisle Syn Tec, Inc.; Sure-Flex KEE HP.
b. GAF; EverGuard PVC KEE.
c. Johns Manville, Inc.; JM PVC KEE.

2. Membrane Thickness: 60 mils (1.5 mm), minimum.
3. Membrane Thickness: 80 mils (2.0 mm), minimum.
4. Exposed Face Color: White.
5. Exposed Face Color: As selected by Architect from manufacturer's standard colors.
6. Exposed Face Color: Custom color to be determined by Architect.

D. PVC KEE Membrane Roofing System, Fleece or Felt Backed: ASTM D 4434, Type II glass-fiber reinforced or Type III polyester fabric reinforced membrane, fleece or felt backed.

1. Manufacturers and Products.

a. Carlisle Syn Tec, Inc.; Sure-Flex KEE HP Fleeceback.
b. GAF; EverGuard PVC KEE Fleece-Back.
c. Johns Manville, Inc.; JM PVC KEE FB.

2. Membrane Thickness: 60 mils (1.5 mm), minimum.

a. Composite Thickness: 115 mils (2.8 mm), nominal, or minimum weight of 3.5 oz./sq. yd.

3. Membrane Thickness: 80 mils (2.0 mm), minimum.

a. Composite Thickness: 135 mils (2.8 mm), nominal, or minimum weight of 3.5 oz./sq. yd.

4. Exposed Face Color: White.
5. Exposed Face Color: As selected by Architect from manufacturer's standard colors.
6. Exposed Face Color: Custom color to be determined by Architect.

2.5 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

A. TPO Membrane Roofing System: ASTM D 6878, internally fabric or scrim reinforced membrane.

1. Manufacturers and Products:

a. Carlisle SynTec Inc.; Sure-Weld TPO.
b. Firestone Building Products Co.; UltraPly TPO.
c. Johns Manville, Inc.; JM TPO.

2. MembraneThickness: 60 mils (1.5 mm), nominal.
3. Membrane Thickness: 80 mils (2.0 mm), minimum.
4. Exposed Face Color: White.
5. Exposed Face Color: As selected by Architect from manufacturer's standard colors.

B. TPO Membrane Roofing System, Fleece or Felt Backed: ASTM D 6878, internally fabric or scrim reinforced membrane, fleece backed.

1. Manufacturers and Products:

a. Carlisle SynTec Inc.; Sure-Weld FleeceBACK TPO.
b. Johns Manville; JM TPO FB 115.

2. Membrane Thickness: 60 mils (1.5 mm), nominal.

a. Composite Thickness: 115 mils (2.8 mm), nominal.

3. Membrane Thickness: 80 mils (2.0 mm), minimum.

a. Composite Thickness: 135 mils (2.8 mm), nominal.

4. Exposed Face Color: White.
5. Exposed Face Color: As selected by Architect from manufacturer's standard colors.

2.6 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

A. EPDM Membrane Roofing System; Fully Adhered: ASTM D4637/D4637M, Type I non-reinforced or Type II reinforced, fire-retardant membrane.

1. Manufacturers and Products:

a. Carlisle SynTec Inc.; Sure-White EPDM.
b. Firestone Building Products Co.; RubberGard EPDM.
c. Johns Manville, Inc.; JM EPDM NR 60 mil.

2. Membrane Thickness: 60 mils (1.5 mm), nominal.
3. Exposed Face Color: White.

B. EPDM Membrane Roofing System; Fully Adhered Fleece or Felt Backed: ASTM D4637/D4637M, Type III non-reinforced, fire-retardant membrane, fleece backed.

1. Manufacturers and Products:

a. Carlisle SynTec Inc.; Sure-White FleeceBACK EPDM.

2. Membrane Thickness: 60 mils (1.5 mm), nominal.
3. Composite Thickness: 115 mils (2.8 mm), nominal.
4. Exposed Face Color: White.

2.7 KETONE ETHYLENE ESTER (KEE) ROOFING

A. KEE Sheet Membrane Roofing System, Fully Adhered: ASTM D6754/D6754M, fabric reinforced membrane.

1. Manufacturers and Products:

a. Seaman Corporation; FiberTite-SM Membrane.

2. Membrane Thickness: 45 mils (1.1 mm), nominal.
3. Membrane Thickness: 60 mils (1.5 mm), nominal.
4. Exposed Face Color: White.
5. Exposed Face Color: As selected by Architect from manufacturer's standard colors.

B. KEE Sheet Membrane Roofing System, Fully Adhered Fleece or Felt Backed: ASTM D6754/D6754M, fabric reinforced membrane, fleece backed.

1. Manufacturers and Products:

a. Seaman Corporation; FiberTite-SM-FB Membrane.

2. Membrane Thickness: 45 mils (1.1 mm), nominal.
3. Membrane Thickness: 60 mils (1.5 mm), nominal.
4. Exposed Face Color: White.
5. Exposed Face Color: As selected by Architect from manufacturer's standard colors

2.8 PROTECTION MEMBRANE AT DECORATIVE PAVER OR DECORATIVE STONE ASSEMBLY

A. Polyviniyl Chloride Protection Membrane: ASTM D 4434, Type III, fabric reinforced 51 mils minimum thickness.

B. TPO Protection Membrane: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO sheet, 45 mils minimum thickness.

C. EPDM Protection Membrane: ASTM D 4637, Type I, non-reinforced, fire-retardant, uniform, flexible EPDM sheet, 45 mils minimum thickness.

D. KEE Sheet Protection Membrane: ASTM D 6754/D 6754M, fabric reinforced and coated with a proprietary compound utilizing Ketone Ethylene Ester (KEE) as the principle polymer in the hybrid vinyl alloy, 36 mil minimum thickness.

2.9 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. "Standing Seam" Extrusions: Surface-applied extrusions that simulate the appearance of a standing seam metal rib roof system; made of same material and color as roofing membrane.

C. Sheet Membrane Flashing: Manufacturer's standard sheet flashing membrane, of recommended thickness and compatible with roofing membrane, of same color as roofing membrane, and appropriate for Project roofing application.

D. Clad Sheet Metal Flashing: Manufacturer's standard clad stainless steel flashing, minimum 24 gauge, of same color as roofing membrane

E. Pipe / Stack Flashing: Pre-molded flexible membrane pipe collar with aluminum ring bonded to base as recommended by roofing system manufacturer.

F. Roof Vents: When recommended by roof membrane manufacturer.

1. Size: Not less than 4-inch (100-mm) diameter.

G. Bonding Adhesive: Manufacturer's standard bonding adhesive.

H. Roof Flashing Adhesive: Manufacturer's standard elastomeric contact adhesive for flashing details.

I. Fluid Applied, Reinforced Liquid Flashing: Manufacturer's standard two-component polymethyl-methacrylate-based liquid flashing.

1. Basis of Design: Sika Sarnafil Inc.; Liquid Flashing.

J. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

K. Metal Termination Bars: ASTM A 666, Type 304 formed stainless steel or extruded alloy 6063 aluminum bars; 2 types, one flat and one flat with upper flange shaped to receive sealant, locations as indicated; 1 in by 1/8 in (25 mm by 3 mm) thick; predrilled at 8 in (200 mm) centers; with corrosive resistant fasteners. No plastic bars allowed.

L. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

1. All fasteners, anchors, nails, straps, bars and other concrete or wood fasteners shall be stainless steel.

M. Miscellaneous Accessories: Preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

N. Seaming Material: Manufacturer's standard splicing adhesive and splice cleaner or primer and splice tape with release film.

O. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.

P. Sealant Pockets (aka Ptich Pans) at Roof Penetrations: Sealant pockets (aka pitch pans) at roofing penetrations are not allowed and will be considered non-conforming work. Refer to drawings for allowable penetration details.

2.10 CONCRETE MOISTURE BARRIER / VAPOR RETARDER

A. Concrete Moisture Barrier/Vapor Retarder: Products and systems formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates prior to installation of roofing materials. Concrete moisture barrier shall be recommended and approved in writing by roofing system manufacturer.

2.11 SUBSTRATE BOARDS FOR FIRE RESISTANCE

A. Substrate Boards for Fire-Resistance: One of the following:

1. Gypsum Substrate Board: ASTM C 1396 / C 1396M, Type X, gypsum board with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges, 5/8 in (15 mm) thick.
2. Glass-Faced Exterior Substrate Board: ASTM C 1177 / C 1177M, Type X, glass-mat, water resistant exterior gypsum sheathing board specifically manufactured for use beneath roofing systems, 5/8 in (15 mm) thick.

   a. Manufacturers and Products:

      1) Georgia-Pacific Gypsum LLC; DensDeck FireGuard Prime.
      2) National Gypsum; DEXcell FA Glass Mat Roof Board.

3. Exterior Gypsum Substrate Board: ASTM C 1278 / C 1278M, Type X, exterior gypsum sheathing board specifically manufactured for use beneath roofing systems. Non-combustible, cellulosic-fiber-reinforced, moisture-resistant gypsum core, 5/8 in (15 mm) thick.

   a. Manufacturers and Products:

      1) USG; SECUROCK Gypsum-Fiber Roof Board

2.12 SUBSTRATE BOARDS FOR VAPOR RETARDER

A. Substrate Boards: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.

1. Manufacturers and Products:

   a. Georgia-Pacific Gypsum LLC; DensDeck Prime.
   b. National Gypsum; DEXcell FA Glass Mat Roof Board.
   c. USG; SECUROCK Gypsum-Fiber Roof Board.

2. Thickness: Minimum 1/2 in (12 mm).

2.13 VAPOR RETARDER

A. Self-Adhering-Sheet Vapor Retarder: Minimum 40-mil- (1.0-mm-) composite consisting of self-adhering rubberized asphalt and laminated film backing, maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m). Provide primer when recommended by vapor retarder manufacturer.

1. Basis of Design: Carlisle Syntec Systems; VapAir Seal 725 TR Air and Vapor Barrier/Temporary Roof.
2. Basis of Design: Sika Sarnafil; Sarnavap 32 Self-Adhered.
3. Basis of Design: As recommended by sheet membrane roofing system manufacturer.

2.14 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roof membrane manufacturer. Comply with requirements of referenced standards, selected from manufacturer's standard sizes and of thicknesses. Provide accessories recommended by insulation manufacturer for intended use and compatible with roofing membrane.

1. Provide insulation thickness required to maintain minimum aged R-value as indicated on the Drawings.
2. Insulation board thickness of individual insulation layers to be 2.6 in (65 mm) maximum.
3. Insulation board size to be 4 ft by 4 ft (1.22 m by 1.22 m) maximum.
4. Provide factory, tapered insulation boards where indicated for sloping to drains. Fabricate with 1/4 in (6 mm) per 12 in (300 mm) (1:48) taper, unless otherwise indicated.
5. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 2, Grade 2, coated polymer bonded glass-fiber mat facers on both major surfaces.

1. Compressive Strength: 20 psi (138 kPa).

C. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 2, Grade 3, coated polymer bonded glass-fiber mat facers on both major surfaces.

1. Compressive Strength: 24 psi (172 kPa)

2.15 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Cold Fluid-Applied Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Bead-applied, low-rise, two-component urethane adhesive.

a. Basis of Design (Product Standard): OMG Inc.; Olybond 500.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

D. Treated Wood Nailers: Comply with requirements in Division 06 Section Miscellaneous Rough Carpentry.

2.16 ROOF COVER BOARDS

A. Roof Cover Boards: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.

1. Manufacturers and Products:

a. Georgia-Pacific Gypsum LLC; DensDeck Prime.
b. National Gypsum; DEXcell FA Glass Mat Roof Board.
c. USG; SECUROCK Gypsum-Fiber Roof Board.

2. Thickness: Minimum 1/4 in (6 mm); or thickness as required to meet performance requirements.
3. Thickness: Minimum 1/2 in (12 mm); or as required to meet performance requirements.

4. Thickness at Vertical Cover Boards (Back of Parapet): 5/8 in (16 mm).

B. Roof Cover Boards: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.

1. Manufacturers and Products:

a. Georgia-Pacific Gypsum LLC; DensDeck StormX Prime.
b. National Gypsum; DEXcell FA VSH Glass Mat Roof Board.

2. Thickness: Minimum 5/8 in (16 mm).

2.17 FLEXIBLE WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 in (5 mm) thick, as recommended by roofing system manufacturer.

1. Size: Approximately 36 by 60 inches (914 by 1524 mm).
2. Color: As selected by Architect.

2.18 PRECAST CONCRETE WALKWAY PAVERS

A. Precast Concrete Walkway Pavers: Heavyweight, hydraulically pressed, concrete units, with top edges beveled 3/16 in (5 mm), factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67.

1. Size: 24 in by 24 in (600 by 600 mm), nominal.
2. Thickness: 2 in (50 mm), nominal
3. Minimum Weight: 22 lb/sf (110 kg/sm).
4. Basis of Design: Hanover Architectural Products; Pedestal Paver with Integrated Concrete Foot for Water Drainage.

a. Colors and Textures: As selected by Architect from manufacturer's full range.

B. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric mat, water permeable and resistant to ultraviolet degradation, type and weight as recommended by roofing system manufacturer for application.

2.19 DECORATIVE PAVERS

A. Decorative Pavers and Pedestals: Refer to Division 07 Section Roof Paver and Pedestal Assemblies.

B. Protection Membrane: As indicated in "Protection Membranes" above; type and weight as recommended by roofing system manufacturer for application.

2.20 DECORATIVE STONE

A. Decorative Stone: Provide washed, smooth decorative stone that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of type and size as selected by Architect; minimum 3 in to 4 in (75 mm to 100 mm) diameter.

B. Protection Membrane: As indicated in "Protection Membranes" above; type and weight as recommended by roofing system manufacturer for application.

2.21 FLASHING AND SHEET METAL

A. Flashing and Sheet Metal: Refer to Division 07 Section Sheet Metal Flashing and Trim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions, including concrete moisture content, have been corrected in a manner complying with roofing manufacturer recommendations and Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thickness of insulation.
3. Metal Decking Substrates:

a. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section Steel Roof Decking.

4. Cast-in-Place Concrete or Composite Metal Deck Substrates:

a. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
b. Concrete Moisture Testing: Perform one or both of the following tests as recommended by roofing manufacturer. Proceed with installation only after concrete substrates pass testing.

1) Concrete Internal Relative Humidity: Not more than 75 percent, or as recommended by NRCA and roofing system manufacturer, when tested according to ASTM F2170.

a) Test Frequency: Perform three test probes for the first 1000 sq. ft. (93 sq. m) and one test probe per each 1000 sq. ft. (93 sq. m), or portion thereof, of roof deck, with no fewer than three test probes.
b) Submit test reports within 24 hours of performing tests.

2) Manufacturer Concrete Moisture Test: Roofing manufacturer standard moisture test with measurements or results acceptable to roofing manufacturer.

c. Concrete Moisture Barrier/Vapor Retarder: For concrete substrates not meeting moisture test standards specified above, install concrete moisture barrier/vapor retarder to concrete substrate in accordance with manufacturer's written instructions.
d. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

5. At lightweight insulating concrete substrates:

a. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
b. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or as recommended by roofing manufacturer.

B. Substrate Surface Temperature at Cold Fluid-Applied Insulation Adhesive: Confirm that concrete substrate or substrate board surface temperature is a minimum 50 deg F (10 deg C) prior to application of adhesive.

3.2 INSTALLATION OF ROOFING, GENERAL

A. General: Comply with recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.

B. General: Comply with roofing system manufacturer's written instructions for installing roof system. Install roofing system to resist uplift pressure at corners, perimeter, and field of roof in accordance with performance requirements.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency, if applicable.

1. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

D. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and not to void warranty for existing roofing system.

F. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified in other sections.

G. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

H. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

D. Install sound absorbing roof deck insulation strips, specified in Division 05 Section Steel Decking, according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and keep dry.

3.4 INSTALLATION OF SUBSTRATE BOARDS

A. Fasten substrate boards to top flanges of steel deck according to recommendations in FMG Approvals' RoofNav and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

B. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

C. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches (610 mm) in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.

3.5 INSTALLATION OF VAPOR RETARDER

A. Vapor Retarder: Install according to roofing system manufacturer's written instructions.

B. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
2. Continuously seal side and end laps with tape.

C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into single-ply roofing.

3.6 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 in (50 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer

C. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

1. Install base layer of insulation with joints staggered not less than 24 inches (610 mm) in adjacent rows.

a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
b. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
c. Trim insulation so that water flow is unrestricted.
d. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

e. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.

a. Staggered end joints within each layer not less than 24 inches (610 mm) in adjacent rows.
b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
d. Trim insulation so that water flow is unrestricted. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

1) Install tapered insulation under area of roofing to conform to slopes indicated.

e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
g. Adhere each layer of insulation to substrate using the following adhesive setting methods in accordance with manufacturer recommendations and performance requirements.

1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
2) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

D. Installation Over Metal Decking:

1. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
2. Adhere upper layers of insulation in accordance with manufacturer recommendations and performance requirements.

E. Installation Over Cast-In-Place Concrete or Composite Metal and Concrete Decks:

1. Adhere base layer of insulation to concrete roof deck in accordance with manufacturer recommendations and performance requirements.
2. Adhere upper layers of insulation in accordance with manufacturer recommendations and performance requirements.

3.7 INSTALLATION OF COVER BOARDS

A. Install roof cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 in (150 mm) in each direction. Loosely butt roof cover boards together.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.

4. Adhere cover board to insulation using the following adhesive setting methods in accordance with manufacturer recommendations and performance requirements.
   a. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
   b. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
5. Score boards, if necessary, to conform to substrate irregularities. Comply with manufacturer's installation recommendations to insure proper adhesion and adhesive set.

3.8 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Accurately align roof membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

E. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations and perimeter of roofing.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
   2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

I. Seams: Bond lapped seams together with seam tape or adhesive as recommended by the manufacturer.
   1. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
      a. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
   2. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

J. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

K. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weather-tightness of transition and to not void warranty for existing roofing system.

3.9 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Seams: Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Heat weld side and end laps to ensure a watertight seam installation.

E. Seams: Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

1. Flash penetrations and field-formed inside and outside corners with cured or uncured EPDM sheet flashing.

F. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.10 INSTALLATION OF STANDING SEAM EXTRUSIONS

A. Installation of extrusions shall be performed by installation personnel that have completed a mandatory installation and welding training course required by roofing membrane manufacturer.

B. Install extrusions parallel with roof slope. Roofing membrane surface must be clean so as to obtain a proper weld between the extrusion and roofing membrane.

C. Pre-assemble extrusions on the roof to the required length. Join Individual lengths using connector and push together. Align extrusion with edge of membrane overlap, do not cover overlap. Check membrane seams and re-weld as required prior to extrusion installation.

D. Install extrusions parallel with roof slope. Roofing membrane surface must be clean so as to obtain a proper hold between the extrusion and roofing membrane.

E. Pre-assemble extrusions on the roof to the required length. Join Individual lengths using connector and push together. Align extrusion with edge of membrane overlap, do not cover overlap. Check membrane seams and re-prime roof membrane as required prior to extrusion installation. Attach extrusions with butyl tape.

3.11 INSTALLATION OF WALKWAYS

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

1. Provide 6-inch (76-mm) clearance between adjoining pads.
2. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

B. Walkway Locations: Locations as indicated on Drawings and as follows:

1. Perimeter of each rooftop unit.
2. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.

3. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
4. Top and bottom of each roof access ladder.
5. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
6. As required by roof membrane manufacturer's warranty requirements.

C. Precast Concrete Walkway Pavers: Install protection mat loose-laid over roofing membrane cap sheet; overlap joints 6 in (150 mm). Loose lay pavers over protection mat, butting pavers together.

3.12 PROTECTION MEMBRANE INSTALLATION AT DECORATIVE STONE AND DECORATIVE PAVER OVERBURDEN ASSEMBLY

A. Loose-Laid Protection Membrane:

1. Loose-lay protection membrane over roofing membrane in accordance with manufacturer's recommendation.
2. Do not apply bonding adhesive to splice area of protection membrane.
3. Roll protection membrane in place in accordance with manufacturer's recommendations.
4. Adhere protection membrane at edges and other locations in accordance with manufacturer's recommended locations and adhesive.

B. Clean seam areas, overlap protection membrane, and hot-air weld side and end laps of protection membrane according to manufacturer's written instructions.

C. Decorative Pavers and Pedestals: Refer to Division 07 Section Roof Paver and Pedestal Assemblies.

D. Decorative Stone: Apply aggregate uniformly over protection membrane to a minimum depth of 3 in (75 mm).

3.13 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
2. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

B. Manufacturer’s Cold Fluid-Applied Insulation Adhesive Inspection: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Test Cuts: The cold fluid-applied insulation adhesive manufacturer shall perform field quality control test cuts of the cold fluid-applied insulation adhesive installation.

C. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control, including infrared inspections on installed roof assemblies.

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
2. Infrared Thermography: Testing agency shall survey entire roof area using infrared color thermography according to ASTM C1153.

a. Perform tests before overlying construction is placed.
b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.

1) Cost of retesting is Contractor's responsibility.

d. Testing agency shall prepare survey report of initial scan indicating locations of entrapped moisture, if any.

D. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.14 REPAIR, CLEANING, AND PROTECTION

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 075216
MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Modified bituminous membrane roofing system and supplementary items necessary for installation.

1. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing system.
2. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing system over lightweight insulating concrete.

B. Related Requirements:

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
2. Lightweight Insulating Concrete: Refer to Division 03 Section Lightweight Insulating Concrete for embedded insulation board.

1.2 ALLOWANCES

A. Allowance for Concrete Moisture Barrier/Vapor Retarder: Include allowance to provide Roofing Manufacturer's recommended concrete moisture barrier/vapor retarder for concrete substrates that do not comply with Roofing Manufacturer's concrete moisture content and testing requirements.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing Work in this Section.

B. Roof Edge Regions: Definitions from ANSI/SPRI ES-1 shall be applicable to this project.

C. SBS: Styrene-butadiene-styrene.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

a. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Show base flashings, cants, and membrane terminations.
2. Show layout and thickness of flat insulation.
3. Show layout and thickness of tapered insulation, including slopes.
4. Show crickets and saddles, including slopes.
5. Show roof plan showing orientation of membrane roofing and fastener spacing.
6. Show insulation and cover board fastening or adhesive patterns for corner, perimeter, and field-of-roof locations.

7. Show cold-applied adhesive pattern for insulation installation; typical pattern of a 100 square foot area.
8. Include project specific details for typical and non-typical conditions.

C. Samples for Verification Purposes: For the following products:

1. Roofing membrane cap sheet, 12 in by 12 in (300 mm by 300 mm) square of color specified, including side and end lap seam.
2. Flashing sheets.
3. Vapor Retarder, 12 in by 12 in (300 mm by 300 mm) square.
4. Roof insulation and cover board.
5. Termination bars.
6. Fasteners of each type, length, and finish.
7. Walkways, of color required.
8. Roof paver, full sized, in each color and texture required.
9. Decorative stone, 10 lb (4.5 kg) in gradation and color indicated.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1. Decorative Stone or Pavers: Comply with applicable provisions of ANSI-SPRI RP-4.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturers Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with Performance Requirements.

a. Submit evidence of compliance with performance requirements.

2. Roofing manufacturer shall review and approve Shop Drawings in writing prior to submission.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

C. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

D. Concrete Roof Deck - Moisture Content Measurement: Submit recorded readings when requested.

1. Submit moisture content readings to roofing manufacturer.

E. Substrate Surface Temperature Readings at Cold Fluid-Applied Insulation Adhesive: Submit recorded readings when requested.

1. Submit surface temperature readings to roofing manufacturer.

F. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Insurance Certification: Assist Owner in preparing and submitting roof installation acceptance certification as necessary in connection with fire and extended-coverage insurance on roofing and associated work.

D. Quality Standards:

1. Unless otherwise recommended by roofing system manufacturer, provide roofing system in accordance with recommendations of the NRCA "Roofing and Waterproofing Manual" for roofing type indicated.
2. Comply with FMG System Loss Prevention Data Sheets 1-28 and 1-28S for design wind loads and wind uplift pressures on roofs for Windstorm Resistance Classification indicated.
3. Comply with FMG System Loss Prevention Data Sheet 1-29 for roof deck securement and above deck components for Windstorm Resistance Classification indicated.
4. Comply with FMG System Loss Prevention Data Sheet 1-49 for perimeter flashing for Windstorm Resistance Classification indicated.

1.8 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor (superintendent).
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications
g. Review deck substrate requirements for conditions and finishes, including flatness, presence of moisture, and fastening.
h. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.

1) Review foil faced flashing and confirm acceptable installation appearance with Architect.

i. Review governing regulations and requirements for insurance and certificates if applicable.
j. Review temporary protection requirements for roofing during and after installation.
k. Review roof observation and repair procedures after roofing installation.

3. Record discussions, including decisions and agreements, and prepare report.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to roofing system manufacturer's written instructions and warranty requirements.

1.11 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.12 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written "Total Roofing System" warranty signed by an authorized representative using manufacturer's standard form, without monetary limitation (NDL), agreeing to repair or replace components of roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects" is defined to include, but not limited to, deterioration or failure to perform as required.

1. Warranty Wind Speed: Minimum 90-mph Peak Gust Wind Speed.
2. Warranty includes roofing, flashings, adhesives, sealants, insulation, fastener systems, cover board, substrate board, roofing accessories and other components of roofing system.
3. Warranty includes lightweight insulating concrete integral with roofing system as specified in Division 03 Section Lightweight Insulating Concrete.
4. Warranty includes roof edge flashings integral with roofing system as specified in Division 07 Section Sheet Metal Flashing and Trim.
5. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 20 years from date of Substantial Completion.

B. Installer's Warranty: Furnish installer's written warranty signed by an authorized representative using installer's standard form agreeing to repair or replace components of roofing system which exhibit defects in materials or workmanship within specified warranty period. "Defects"is defined to include, but not limited to, deterioration or failure to perform as required.

1. Warranty includes roofing, flashings, adhesives, sealants, insulation, fastener systems, cover boards, substrate board, roofing accessories, and other components of roofing system.
2. Warranty includes lightweight insulating concrete integral with roofing system as specified in Division 03 Section Lightweight Insulating Concrete.
3. Warranty includes roof edge flashings integral with roofing system as specified in Division 07 Section Sheet Metal Flashing and Trim.
4. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and base flashings shall remain watertight.

1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Provide roofing system materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897. Contractor shall obtain required design data and identify requirements accommodated on submittal drawings.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.

D. FM Approvals' Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

1. Fire/Windstorm Classification - Field of Roof: Class 1A-90.
2. Fire/Windstorm Classification - Roof Perimeter / Corner: Class 1A-150 / Class 1A-225.
3. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34.

a. Rating: SH Severe Hail.
b. Rating: VSH Very Severe Hail.

E. Florida Product Approval / NOA Listing: Provide roofing system, base flashings, and component materials that comply with requirements in Florida Product Approval / Notice of Acceptance as part of a roofing system including but not limited to fire resistance, physical properties, pull-through resistance and wind and wind driven rain resistance in accordance with requirements of authorities having jurisdiction.

F. SPRI Wind Design Standard for Edge Systems: Provide edge systems tested in accordance with ANSI/SPRI/FM 4435/ES-1 Wind Test Design Standard for Edge Systems Used with Low Slope Roofing Systems and capable of resisting design pressures.

G. Energy Performance for Low Slope Roofs: Provide roofing system with Solar Reflectance Index calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

1. Initial SRI of not less than 82 or 3-Year Aged SRI of not less than 64.

H. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

I. Energy Performance: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

J. Fire-Test-Response Characteristics: Provide roofing system materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: ASTM E 108, Class A, for application and roof slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

2.4 BASE SHEET MATERIALS

A. Base Sheet, General: Provide one of the following as suitable for application method in compliance with performance requirements

B. SBS-Modified Bitumen Polyester Mat Base Sheet: ASTM D6164/D6164M, Type I or Type II, Grade S, SBS-modified asphalt sheet, reinforced with polyester fabric, smooth surfaced, suitable for torch application method.

C. SBS-Modified Bitumen Fiberglass Mat Base Sheet: ASTM D6163/D6163M, Type I or Type II, Grade S, SBS-modified asphalt sheet, reinforced with fiberglass fabric, smooth surfaced, suitable for torch application method.

D. SBS-Modified Bitumen Polyester and Fiberglass Mat Base Sheet: ASTM D6162/D6162M, Type I or Type II, Grade S, SBS-modified asphalt sheet, reinforced with a combination of polyester and fiberglass fabric, smooth surfaced, suitable for torch application method.

E. Vented Base Sheet: ASTM D4897/D4897M, Type II, venting, nonperforated, asphalt-impregnated and -coated, glass-fiber base sheet with mineral granule surfacing on bottom surface; suitable for mechanically fastening to lightweight insulating concrete substrate.

1. Provide vented base sheet in addition to modified bitumen base (intermediate) sheets listed above for installations using lightweight insulating concrete.

2.5 MODIFIED BITUMINOUS CAP SHEET

A. Cap Sheet, General: Factory-surfaced with ceramic-coated roofing granules, subject to prior review and acceptance by Architect. Provide one of the following as suitable for application method in compliance with performance requirements.

B. Granule-Surfaced Roofing Cap Sheet: ASTM D6164/D6164M, Type I or Type II, Grade G, SBS-modified asphalt sheet, reinforced with polyester fabric, suitable for torch application method.

C. Granule-Surfaced Roofing Cap Sheet: ASTM D6163/D6163M, Type I or Type II, Grade G, SBS-modified asphalt sheet, reinforced with fiberglass fabric, suitable for torch application method.

D. Granule-Surfaced Roofing Cap Sheet: ASTM D6162/D6162M, Type I or Type II, Grade G, SBS-modified asphalt sheet, reinforced with a combination of polyester and fiberglass fabric, suitable for torch application method.

E. Manufacturers and Products: Torch application method.

1. GAF; Ruberoid SBS Heat-Weld Plus Granule FR.
2. Johns Manville, Inc.; DynaWeld Cap FR.
3. Siplast; Paradiene 30 FR TG.

4. Soprema; Elastophene Flam HR FR GR, Elastophene Flam LS FR GR, or Sopralene Flam 180 FR GR.

F. Manufacturers and Products: Torch application method, Cool Roof.

1. GAF; Ruberoid EnergyCap SBS Heat-Weld Plus FR
2. Johns Manville, Inc.; DynaWeld Cap FR CR.
3. Siplast; Paradiene CR 30 FR TG.
4. Soprema; Soprastar Flam 180 FR

2.6 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: Type I or II, Grade S, SBS-modified asphalt sheet, reinforced, smooth surfaced, matching cap sheet material and suitable for application method specified.

B. Granule-Surfaced Flashing Sheet: Type I or II, Grade G, SBS-modified asphalt sheet, reinforced, granule surfaced, matching cap sheet material and suitable for application method specified, and as follows:

1. Granule Color: Match roofing membrane cap sheet.

C. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D1668/D1668M, Type I.

D. Liquid Flashing System: Roof membrane manufacturer's standard one- or two-part moisture curing resin with low solvent content, consisting of a primer, flashing cement, and scrim.

1. Manufacturers and Products:

a. GAF; MajorSeal Flashing System or PMMA Flashing System.
b. Johns Manville, Inc.; PermaFlash Bituminous Flashing System.
c. Siplast; Parapro 123 Flashing System or Paraflex STP.
d. Soprema; Alsan Flashing System.

2. Locations:

a. Base of pipe and vent stack.
b. Primary and overflow drains.
c. Locations indicated on Drawings.
d. Locations recommended by roof membrane manufacturer.
e. As required by roof membrane manufacturer's warranty requirements

2.7 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Metal Flashing: Refer to Division 07 Section Sheet Metal Flashing and Trim.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Roof Vents: As recommended by roof membrane manufacturer.

1. Size: Not less than 4-inch (100-mm) diameter.

E. Metal Termination Bars: ASTM A 666, Type 304 formed stainless steel or extruded alloy 6063 aluminum bars; 2 types, one flat and one flat with upper flange shaped to receive sealant,

locations as indicated; 1 in by 1/8 in (25 mm by 3 mm) thick; predrilled at 8 in (200 mm) centers; with corrosive resistant fasteners. No plastic bars allowed.

F. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required by roofing system manufacturer for application.

G. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

I. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 (2.36-mm) sieve and 98 percent of mass retained on No. 40 (0.425-mm) sieve; color to match roof membrane.

J. "Cool" Roofing Flakes: Highly reflective white flat angular pigmented polymer flakes that meet the Energy Performance requirements, color and size to match cap sheet roofing membrane.

K. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

L. Sealant Pockets (aka Ptich Pans) at Roof Penetrations: Sealant pockets (aka pitch pans) at roofing penetrations are not allowed and will be considered non-conforming work. Refer to drawings for allowable penetration details.

2.8 CONCRETE MOISTURE BARRIER / VAPOR RETARDER

A. Concrete Moisture Barrier/Vapor Retarder: Products and systems formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates prior to installation of roofing materials. Concrete moisture barrier shall be recommended and approved in writing by roofing system manufacturer.

2.9 SUBSTRATE BOARDS FOR FIRE RESISTANCE

A. Substrate Boards for Fire-Resistance: One of the following:

1. Gypsum Substrate Board: ASTM C 1396 / C 1396M, Type X, gypsum board with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges, 5/8 in (15 mm) thick.
2. Glass-Faced Substrate Board: ASTM C 1177 / C 1177M, Type X, glass-mat, water-resistant exterior gypsum sheathing board specifically manufactured for use beneath roofing systems, 5/8 in (15 mm) thick.

   a. Manufacturers and Products:

      1) Georgia-Pacific Gypsum LLC; DensDeck FireGuard Prime.
      2) National Gypsum; DEXcell FA Glass Mat Roof Board.

3. Exterior Gypsum Substrate Board: ASTM C 1278 / C 1278M, Type X, exterior gypsum sheathing board specifically manufactured for use beneath roofing systems. Non-combustible, cellulosic-fiber-reinforced, moisture-resistant gypsum core, 5/8 in (15 mm) thick.

   a. Manufacturers and Products:

      1) USG; SECUROCK Gypsum-Fiber Roof Board.

2.10 SUBSTRATE BOARDS FOR VAPOR RETARDER

A. Substrate Boards: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.

1. Manufacturers and Products:

a. Georgia-Pacific Gypsum LLC; DensDeck Prime.
b. National Gypsum; DEXcell FA Glass Mat Roof Board.
c. USG; SECUROCK Gypsum-Fiber Roof Board.

2. Thickness: Minimum 1/2 in (12 mm).

2.11 VAPOR RETARDER

A. Vapor Retarder: One of the following as recommended by roofing manufacturer for this project.

B. Self-Adhering-Sheet Vapor Retarder: ASTM D1970/D1970M polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil- (1.0-mm-) total thickness; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

C. Self-Adhering-Sheet Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil- (0.76- mm-) total thickness; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.12 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roof membrane manufacturer. Comply with requirements of referenced standards, selected from manufacturer's standard sizes and of thicknesses. Provide accessories recommended by insulation manufacturer for intended use and compatible with roofing membrane.

1. Provide insulation thickness required to maintain minimum aged R-value as indicated on the Drawings.
2. Insulation board thickness of individual insulation layers to be 2.6 in (65 mm) maximum.
3. Insulation board size to be 4 ft by 4 ft (1.22 m by 1.22 m) maximum.
4. Provide factory, tapered insulation boards where indicated for sloping to drain. Fabricate with 1/4 in (6 mm) in per 12 in (300 mm) (1:48) taper, unless otherwise indicated.
5. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 2, Grade 2, coated polymer bonded glass-fiber mat facers on both major surfaces.

1. Compressive Strength: 20 psi (138 kPa).

C. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 2, Grade 3, coated polymer bonded glass-fiber mat facers on both major surfaces.

1. Compressive Strength: 24 psi (172 kPa).

2.13 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Cold Fluid-Applied Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Bead-applied, low-rise, two-component urethane adhesive.

a. Basis of Design (Product Standard): OMG Inc.; Olybond 500.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

D. Treated Wood Nailers and Cant Strips: Comply with requirements in Division 06 Section Miscellaneous Rough Carpentry.

2.14 ROOF COVER BOARDS

A. Roof Cover Boards: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.

1. Manufacturers and Products:

a. Georgia-Pacific Gypsum LLC; DensDeck Prime.
b. National Gypsum; DEXcell FA Glass Mat Roof Board.
c. USG; SECUROCK Gypsum-Fiber Roof Board.

2. Thickness: Minimum 1/4 in (6 mm); or as required to meet performance requirements.
3. Thickness: Minimum 1/2 in (12 mm); or as required to meet performance requirements.
4. Thickness at Vertical Cover Boards (Back of Parapet): 5/8 in (16 mm).

B. Roof Cover Boards: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.

1. Manufacturers and Products:

a. Georgia-Pacific Gypsum LLC; DensDeck StormX Prime.
b. National Gypsum; DEXcell FA VSH Glass Mat Roof Board.

2. Thickness: 5/8 in (16 mm).

2.15 ASPHALT MATERIALS

A. Asphalt Primer: ASTM D41/D41M.

2.16 WALKWAYS

A. Walkway Pads (Composition Protection Course): Reinforced asphaltic composition pads with slip-resisting mineral-granule surface, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, 3/8 inch (10 mm) thick, minimum.

1. Pad Size: Approximately 36 by 60 inches (914 mm by 1524 mm).
2. Color: Contrasting with cap sheet.

B. Walkway Cap-Sheet Strips (Modified Bitumen Protection Course): Type I or II, Grade G, SBS-modified asphalt sheet, reinforced with polyester fabric or glass fibers; granule surfaced; suitable for application method specified, and as follows.

1. Basis of Design: Siplast; Paratread.
2. Size: 36 by 60 inches (914 mm by 1524 mm).

3. Granule Color: As selected from manufacturer's standard colors; contrasting with cap sheet.

2.17 PRECAST CONCRETE WALKWAY PAVERS

A. Precast Concrete Walkway Pavers: Heavyweight, hydraulically pressed, concrete units, with top edges beveled 3/16 in (5 mm), factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67.

1. Size: 24 in by 24 in (600 by 600 mm), nominal.
2. Thickness: 2 in (50 mm), nominal.
3. Minimum Weight: 22 lb/sf (110 kg/sm).
4. Basis of Design: Hanover Architectural Products; Pedestal Paver with Integrated Concrete Foot for Water Drainage.

a. Colors and Textures: As selected by Architect from manufacturer's full range.

B. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric mat, water permeable and resistant to ultraviolet degradation, type and weight as recommended by roofing system manufacturer for application.

2.18 DECORATIVE PAVERS

A. Decorative Pavers and Pedestals: Refer to Division 07 Section Roof Paver and Pedestal Assemblies.

B. Protection Mat: SBS-modified asphalt cap sheet, granular surfaced; type and weight as recommended by roofing system manufacturer for application.

1. Basis of Design (Product Standard): Siplast; Paratread System.

2.19 DECORATIVE STONE

A. Decorative Stone: Provide washed, smooth decorative stone that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of type and size as selected by Architect; minimum 3 in to 4 in (75 mm to 100 mm) diameter.

B. Protection Mat: SBS-modified asphalt cap sheet, granular surfaced; type and weight as recommended by roofing system manufacturer for application.

1. Basis of Design (Product Standard): Siplast; Paratread System.

2.20 FLASHING AND SHEET METAL

A. Flashing and Sheet Metal: Refer to Division 07 Section Sheet Metal Flashing and Trim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions, including concrete moisture content, have been corrected in a manner complying with roofing manufacturer recommendations and Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thickness of insulation.
3. Metal Decking Substrates:
   a. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section Steel Roof Decking.
4. Cast-in-Place Concrete or Composite Metal Deck Substrates:
   a. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
   b. Concrete Moisture Testing: Perform one or both of the following tests as recommended by roofing manufacturer. Proceed with installation only after concrete substrates pass testing.
      1) Concrete Internal Relative Humidity: Not more than 75 percent, or as recommended by NRCA and roofing system manufacturer, when tested according to ASTM F2170.
         a) Test Frequency: Perform three test probes for the first 1000 sq. ft. (93 sq. m) and one test probe per each 1000 sq. ft. (93 sq. m), or portion thereof, of roof deck, with no fewer than three test probes.
         b) Submit test reports within 24 hours of performing tests.
      2) Manufacturers Concrete Moisture Test: Roofing manufacturer's standard moisture test with measurements or results acceptable to roofing manufacturer.
   c. Concrete Moisture Barrier: For concrete substrates not meeting moisture test standards specified above, install concrete moisture barrier to concrete substrate in accordance with manufacturer's written instructions.
   d. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
5. Lightweight Insulating Concrete Substrates:
   a. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
   b. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or as recommended by roofing manufacturer.

B. Substrate Surface Temperature at Cold Fluid-Applied Insulation Adhesive: Confirm that concrete substrate or substrate board surface temperature is a minimum 50 deg F (10 deg C) prior to application of adhesive.

3.2 INSTALLATION OF ROOFING, GENERAL

A. General: Comply with recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.

B. General: Comply with roofing system manufacturer's written instructions for installing roof system. Install roofing system to resist uplift pressure at corners, perimeter, and field of roof in accordance with performance requirements.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency, if applicable.

1. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

D. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and not to void warranty for existing roofing system.

F. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified in other sections.

G. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

H. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with roofing system manufacturer’s instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

D. Install sound absorbing roof deck insulation strips, specified in Division 05 Section Steel Decking, according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and keep dry

3.4 INSTALLATION OF SUBSTRATE BOARDS

A. Fasten substrate boards to top flanges of steel deck according to recommendations in FMG Approvals' RoofNav and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

B. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

C. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches (610 mm) in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.

3.5 INSTALLATION OF VAPOR RETARDER

A. Vapor Retarder: Install according to roofing system manufacturer's written instructions.

B. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
2. Seal laps by rolling.

C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into modified bituminous membrane roofing.

3.6 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 in (50 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 in (150 mm) in each direction.

C. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

1. Install base layer of insulation with joints staggered not less than 24 inches (610 mm) in adjacent rows.

a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
b. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
c. Trim insulation so that water flow is unrestricted.
d. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
e. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.

a. Staggered end joints within each layer not less than 24 inches (610 mm) in adjacent rows.

b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
d. Trim insulation so that water flow is unrestricted. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

1) Install tapered insulation under area of roofing to conform to slopes indicated.

e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
g. Adhere each layer of insulation to substrate using the following adhesive setting methods in accordance with manufacturer recommendations and performance requirements.

1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
2) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

D. Installation Over Metal Decking:

1. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
2. Adhere upper layers of insulation in accordance with manufacturer recommendations and performance requirements.

E. Installation Over Cast-In-Place Concrete or Composite Metal and Concrete Decks:

1. Adhere base layer of insulation to concrete roof deck in accordance with manufacturer recommendations and performance requirements.
2. Adhere upper layers of insulation in accordance with manufacturer recommendations and performance requirements.

3.7 INSTALLATION OF COVER BOARDS

A. Install roof cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 in (150 mm) in each direction. Loosely butt roof cover boards together.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to insulation using the following adhesive setting methods in accordance with manufacturer recommendations and performance requirements.

a. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
b. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

5. Score boards, if necessary, to conform to substrate irregularities. Comply with manufacturer's installation recommendations to insure proper adhesion and adhesive set.

B. Secure roof cover boards to insulation to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturer written instructions.

3.8 INSTALLATION OF BASE SHEET

A. Before installing, unroll base sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature.

B. Installation of Modified Bitumen Base Sheet:

1. Install base sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
2. Extend roofing sheets over and terminate above cants.
3. Install base sheet in a shingle fashion.
4. Torch apply to substrate.

a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.

5. Install base sheet without wrinkles, rears, and free from air pockets.
6. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.

a. Lap side laps as recommended by roof membrane manufacturer but not less than 3 inches (76 mm).
b. Stagger end laps not less than 18 inches (450 mm).
c. Completely bond and seal laps, leaving no voids.
d. Roll laps with a 20-pound (9-kg) roller.

7. Repair tears and voids in laps and lapped seams not completely sealed.
8. Apply pressure to the body of the base sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

C. Installation of Vented Base Sheet:

1. Mechanically fasten, using mechanical fasteners specifically designed and sized for fastening to applicable substrate, vented base sheet with vented side down.

a. Fasten vented base sheet according to requirements in FM Approval's RoofNav for specified Windstorm Resistance Classification.
b. Fasten vented base sheet to resist uplift pressure at corners, perimeter, and field of roof.

3.9 INSTALLATION OF MODIFIED BITUMINOUS CAP SHEET

A. Before installing, unroll cap sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature at which cap sheet will be installed.

B. Install modified bituminous roofing cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.

1. Extend cap sheet over and terminate above cants.
2. Install cap sheet in a shingle fashion.
3. Install cap sheet as follows:

a. Torch apply to substrate.

1) Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.

4. Install cap sheet without wrinkles or tears, and free from air pockets.
5. Install cap sheet, so side and end laps shed water.

C. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.

1. Lap side laps as recommended by roof membrane manufacturer but not less than 3 inches (76 mm).
2. Stagger end laps not less than 18 inches (450 mm).
3. Heat weld laps, leaving no voids.
4. Roll laps with a 20-pound (9-kg) roller.
5. Repair tears and voids in laps and lapped seams not completely sealed.

D. Apply pressure to the body of the cap sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

3.10 INSTALLATION OF FLASHING AND STRIPPING

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Flashing Sheet Application: Torch apply flashing sheet to substrate.

a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.

B. Extend base flashing up walls or parapets a minimum of 8 in (200 mm) above roofing and 4 in (100 mm) onto field of roofing.

C. Using termination bars, mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

D. Install liquid flashing system according to manufacturer's recommendations.

1. Extend liquid flashing not less than 3 inches (76 mm) in all directions from edges of item being flashed.

a. Apply liquid applied reinforced membrane bonded to base at pipe and stacks.

2. Embed granules, matching color of roof membrane, into wet compound.

E. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

F. Roof Drains: Set metal flashing in bed of asphalt roofing cement on completed roofing membrane.

1. Cover metal flashing with roofing cap-sheet stripping and extend a minimum of 4 in (100 mm) to 6 in (150 mm) beyond edge of metal flashing onto field of roofing.
2. Clamp roofing, metal flashing, and stripping into roof-drain clamping ring.
3. Install stripping according to roofing system manufacturer's written instructions.

G. Protection Course for Lightning Protection System: Apply 12 in by 12 in (300 mm by 300 mm) additional layer of base flashing material over the vertical face of parapet for lightning protection system and as recommended by manufacturer.

3.11 INSTALLATION OF WALKWAYS

A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size, according to walkway pad manufacturer's written instructions, using same application method as used for roofing cap sheet.

1. Install walkways at the following locations:

a. Locations indicated on Drawings.
b. As required by roof membrane manufacturer's warranty requirements.

2. Provide 3-inch (76-mm) clearance between adjoining pads.

B. Walkway Cap Sheet Strips: Install walkway cap sheet strips over roofing membrane, using same application method as used for roofing cap sheet.

1. Install walkways strips at the following locations:

a. Perimeter of each rooftop unit.
b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
d. Top and bottom of each roof access ladder.
e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
f. Locations indicated on Drawings.
g. As required by roof membrane manufacturer's warranty requirements.

C. Precast Concrete Walkway Pavers: Install protection mat loose-laid over roofing membrane cap sheet; overlap joints 6 in (150 mm). Loose lay pavers over protection mat, butting pavers together.

3.12 INSTALLATION OF DECORATIVE PAVERS

A. Protection Mat: Install loose-laid over roofing membrane cap sheet according to manufacturer's recommendations.

B. Decorative Pavers and Pedestals: Refer to Division 07 Section Roof Paver and Pedestal Assemblies.

3.13 INSTALLATION OF DECORATIVE STONE

A. Protection Mat: Install loose-laid over roofing membrane cap sheet according to manufacturer's recommendations.

B. Decorative Stone: Apply aggregate uniformly over protection mat to a depth of 3 in (75 mm).

3.14 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
2. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

B. Manufacturer’s Cold Fluid-Applied Insulation Adhesive Inspection: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Test Cuts: The cold fluid-applied insulation adhesive manufacturer shall perform field quality control test cuts of the cold fluid-applied insulation adhesive installation.

C. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control, including infrared inspections on installed roof assemblies.

1. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
2. Infrared Thermography: Testing agency shall survey entire roof area using infrared color thermography according to ASTM C1153.
   a. Perform tests before overlying construction is placed.
   b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
   c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
      1) Cost of retesting is Contractor's responsibility.
   d. Testing agency shall prepare survey report of initial scan indicating locations of entrapped moisture, if any.

D. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:
   a. Materials and installation will be considered defective if they do not meet specified requirements.
   b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
   c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
2. Prepare test and inspection reports.

3.15 REPAIR, CLEANING, AND PROTECTION

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Flashing and sheet metal including but not limited to the assemblies listed below along with supplementary items necessary for installation:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed steep-slope roof sheet metal fabrications.
5. Formed wall and embedded flashing.
6. Formed equipment support flashing.
7. Formed overhead-piping safety pans.

B. Related Requirements:

1. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.
2. Refer to Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
3. Refer to Division 7 Section for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
4. Refer to Division 7 Section "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.2 DELEGATED ENGINEERING REQUIREMENTS FOR COPINGS AND ROOF EDGE FLASHINGS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
2. Include underlayment materials and sealants.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Embedded Flashing: Large-scale details for each element of flashing system showing layout, profiles, methods of joining, and anchorage details; including lintel units, shelf units, corner units, end dam units, conditions showing interface and relationship to adjacent materials, and other special applications.
8. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
9. Include details of roof-penetration flashing.
10. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
11. Include details of special conditions.
12. Include details of connections to adjoining work.

    a. Include isometric details of saddles, end dams, and other complex flashing conditions.

C. Samples for Verification Purposes: Submit for items listed below; provide samples made from 12 in (300 mm) lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1. Sheet Metal Flashing: 12 in (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 in (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1. Provide sealant and underlayment manufacturers certification that their products are compatible with each other, including adhesion.

B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.

C. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.
2. Submit FM Approvals Listing in "RoofNav" for approved for windstorm classification. Identify materials with name of fabricator and design approved by FM Approvals.

E. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer/Fabricator Qualifications: Manufacturer/shop-fabricator with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.

1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop shall be NRCA listed or shall provide other evidence acceptable to Architect as able to fabricate required details as tested and approved.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
    a. Show typical components, attachments to building structure, and requirements of installation.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
    a. Architect.
    b. Contractor, including superintendent.
    c. Installer, including project manager and supervisor.
    d. If requested, Manufacturer's qualified technical representative.
    e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
    a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
    b. Review Contract Document requirements.
    c. Review approved submittals.
    d. Review inspection and testing requirements.
    e. Review environmental conditions and procedures for coping with unfavorable conditions.
    f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing materials and fabrications away from uncured concrete and masonry.

D. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit flashing and sheet metal work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

C. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Installer’s Warranty: Furnish installer’s written warranty signed by an authorized representative using installer’s standard form agreeing to repair or replace components of all sheet metal flashing assemblies that exhibit defects in materials or workmanship within specified warranty period. “Defects” is defined to include, but not limited to, deterioration or failure to perform as required.

1. Warranty Period: 2 years from date of Substantial Completion.

B. Factory Applied Finish Warranty: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Coverage includes but is not limited to the following:

a. Color fading more than 5 Delta E Units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

C. Factory Applied Finish Warranty for Anodic Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

1. Manufacturers:

   a. Cheney Flashing Company.
   b. Fry Reglet Corporation.
   c. Hickman Edge Systems.
   d. Keystone Flashing Company, Inc.
   e. Petersen Aluminum Corporation.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

   1. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure.
   2. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Material Compatibility: Provide flashing and sheet metal materials that are compatible with one another and specified roofing system under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

C. Structural Loads: Installed sheet metal flashing materials and fabrications shall withstand loads within limits of allowable working stresses of the materials involved under conditions indicated, including but not limited to, requirements established by authorities having jurisdiction and applicable building codes.

   1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
   2. Other Loads: As indicated on Drawings.

D. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

E. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

F. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

   1. Design Pressure: Refer to Structural Loads.

G. FM Approvals Listing: Manufacture and install copings and roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification. Identify materials with name of fabricator and design approved by FM Approvals.

   1. Class: Match FM Approvals classification for roofing system.

H. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.4 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.

1. Non-patinated Exposed Finish: Mill.
2. Non-patinated Exposed, Lacquered Finish: Finish designations for copper alloys comply with system defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."

a. Brushed Satin (Lacquered): M32-06x (Mechanical Finish: directionally textured, medium satin; with clear organic coating); coating of "Incralac," waterborne, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to total thickness of 1 mil (0.025 mm).
b. Mirror Polished (Lacquered): M22-06x (Mechanical Finish: buffed, specular; with clear organic coating); coating of "Incralac," waterborne, air-drying, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to total thickness of 1 mil (0.025 mm).

3. Pre-patinated Copper-Sheet Finish: Verdigris, pre-patinated according to ASTM B 882.

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
2. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

a. Color: As scheduled or as indicated in Design Selections.

1) Color Range: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

3. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

a. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
b. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4. Color: As scheduled or as indicated in Design Selections.

5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

D. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 , dead soft, fully annealed; with smooth, flat surface.

1. Finish: 2D (dull, cold rolled).

E. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 316 , dead soft, fully annealed; with smooth, flat surface.

1. Finish: 2D (dull, cold rolled).

F. Metallic-Coated Steel Sheet:

1. Aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A 755/A 755M.
2. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

a. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
b. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color and Gloss: As scheduled or as indicated in Design Selections.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

2.5 UNDERLAYMENT MATERIALS

A. Material Compatibility: Provide underlayment materials that are compatible with substrates and specified roofing system under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

B. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.
3. SBS-Modified Asphalt Adhesive based Manufacturers and Products:

a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
b. GCP Applied Technologies; Ice and Water Shield HT.
c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.

e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

4. Butyl Adhesive based Manufacturers and Products:

a. GCP Applied Technologies; Ultra.

5. Primer: Provided by underlayment manufacturer.
6. Underlayment Sealing Tape: Provided by underlayment manufacturer.
7. Sealant: Approved by underlayment manufacturer, compatible with both adhesive and facer of underlayment material.

C. Slip Sheet: If recommended by manufacturer to separate sheet metal from underlayment; rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.6 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, stainless steel draw bands, solid shims and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Manufacturer's recommended wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed neoprene sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
5. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel.

C. Solder:

1. For Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead with maximum lead content of 0.2 percent.
2. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

D. Rubberized-Asphalt Flexible Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 in (1.02 mm).

1. Manufacturers and Products:

a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
b. Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
c. GCP Applied Technologies; Perm-A-Barrier Wall Flashing.
d. Heckmann Building Products, Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
e. Hohmann & Barnard, Inc.; Textroflash.
f. W.R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
g. Polyguard Products, Inc.; Polyguard 400.

2. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

E. Self-Adhering Metal Sheet Membrane Flexible Flashing: Composite flashing product consisting of flexible 2 mil Type 304 or Type 316 stainless steel sheet, butyl adhesive, interlayer, and siliconized release liner.

1. Manufacturers and Products:

a. York Flashing; Self-Adhering Stainless Steel 304 SA or 316 SA.
b. GE Silicone, Inc.; Elemax SS Flashing.
c. VaproShield, Inc.: Vapro-SS Flashing SA.

2. Accessories: Provide sealants and seaming materials produced by flashing manufacturer.

F. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 in (12 mm) wide and 1/8 in (3 mm) thick.

G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

H. Sealant for Use at Concealed Joints: Sealant shall be compatible with underlayment materials at interfaces. Contractor's option, one of the following:

1. Butyl: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
2. Silicone: ASTM C 920, single-component, neutral cure silicone sealant.

a. Basis of Design: Dow Corning; 758 Silicone Weather Barrier Sealant.

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, or cold-applied asphalt emulsion complying with ASTM D 1187; compounded for 15 mils (0.4 mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.7 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
6. Provide one-piece, watertight saddles at corners, ends and transitions between flashing profiles. Saddles shall have 4-inch flanges and seams shall be mechanically fastened. Uncoated metals shall be fully soldered watertight.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 in in 20 ft (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8 in (3 mm) offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 ft (3 m) with no joints within 24 in (600 mm) of corner or intersection.

D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Soldered Seams - Unfinished or Concealed/Embedded Metals: Fabricate nonmoving seams with flat-lock seams except at corners. Rivet soldered joints for strength and solder over rivets. Solder shall flow through and fill the joint.

1. Corners: Shop fabricate, factory mitered corners with continuously welded or soldered seams. Fabricate corners with no joints within 24 in (600 mm) of corner or intersection.

H. Sealant Seams - Prefinished Metals: Fabricate nonmoving seams with flat-lock seams except at corners. Form seams and seal with elastomeric sealant. Rivet joints where necessary for strength.

1. Corners: Shop fabricate, factory mitered corners. Form seams and seal with elastomeric sealant. Fabricate corners with no joints within 24 in (600 mm) of corner or intersection.

I. Copings 12 Inches Wide or Less: Form butted joints with expansion space and 12 in (300 mm) wide, concealed backup plate with double sealant on each side of joint.

J. Copings Over 12 Inches Wide: Form joints of intermeshing hooked flanges, not less than 1 in (25 mm) deep, filled with sealant concealed within joints.

K. Do not use graphite pencils to mark metal surfaces.

2.8 SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.

1. Fabricate from the Following Materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

a. Stainless Steel: 0.025 in (0.64 mm) thick.
b. Copper, 16 oz./sq. ft. (0.55 mm thick).
c. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
d. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.

2. Corners: Factory mitered, mechanically clinched and sealed or soldered watertight.
3. Joints: Lapped 4-inches, double seal with sealant.
4. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

5. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
6. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
7. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
8. Accessories:
    a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
    b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
9. Finish: With manufacturer's standard color coating, unless indicated otherwise.

2.9 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96 in (2400 mm) long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

1. Gutter Profile: As indicated on Drawings, according to cited sheet metal standard.
2. Accessories: Wire-ball downspout strainer, Valley baffles.
3. Gutters with Girth up to 15 in (375 mm): Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
    a. Copper: 16 oz./sq. ft. (0.55 mm thick).
    b. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
    c. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.
4. Gutters with Girth 16 to 20 In (400 to 500 mm): Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements:
    a. Copper: 16 oz./sq. ft. (0.55 mm thick).
    b. Aluminum, Prefinished: 0.040 in (1.0 mm) thick.
    c. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.
5. Corners: Factory mitered, mechanically clinched and sealed or soldered watertight.
6. Joints: Lapped 4-inches in direction of water flow, double seal with sealant.

B. Built-in Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96 in (2400 mm) long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.

1. Fabricate gutters with built-in expansion joints and gutter-end expansion joints at walls.
2. Accessories: Wire-ball downspout strainer.
3. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.
    a. Stainless Steel: 0.025 in (0.64 mm) thick.
    b. Copper: 16 oz./sq. ft. (0.55 mm thick).

4. Corners and Joints: Factory mitered, solder or weld watertight.

C. Downspouts: Fabricate rectangular, unless indicated otherwise, downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows. Size as recommended by SMACNA.

1. Hanger Style: As indicated, according to SMACNA's "Architectural Sheet Metal Manual."
2. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

a. Copper: 16 oz./sq. ft. (0.55 mm thick).
b. Aluminum, Prefinished: 0.024 inch (0.61 mm) thick.
c. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.

D. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4 in (100 mm) wide wall flanges to interior, and base extending 4 in (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

1. Stainless Steel: 0.025 in (0.64 mm) thick.
2. Copper: 16 oz./sq. ft. (0.55 mm thick).
3. Corners and Joints: Factory mitered, solder or weld watertight.

E. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
3. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.
4. Corners and Joints: Factory mitered, solder or weld watertight.

F. Splash Pans: Fabricate to dimensions and shape required and from the following materials:

1. Stainless Steel: 0.025 in (0.64 mm) thick.
2. Copper: 16 oz./sq. ft. (0.55 mm thick).
3. Aluminum: 0.040 in (1.0 mm) thick.
4. Corners and Joints: Factory mitered, solder or weld watertight.

2.10 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop): Fabricate in minimum 96 in (2400 mm) long, but not exceeding 12 ft (3.6 m) long sections.

1. Profile: As indicated on Drawings, according to SMACNA's "Architectural Sheet Metal Manual."
2. Fabricate to dimensions required with 4 in (100 mm) wide flanges and base extending 4 in (100 mm) beyond cant or tapered strip into field of roof.

a. Provide scuppers at conductor heads.
b. Provide scuppers spaced 10 ft (3 m) apart when discharging into gutters.

3. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

a. Copper: 20 oz./sq. ft. (0.68 mm thick).
b. Aluminum, Prefinished: 0.050 in (1.25 mm) thick.
c. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.040 in (1.0 mm) thick.

4. Corners: Factory mitered and mechanically clinched and sealed or soldered watertight.
5. Joints: Butted with expansion space and 12 in (300 mm) wide, concealed backup plate, double seal with sealant each side of joint.

B. Copings: Fabricate in minimum 96 in (2400 mm) long, but not exceeding 12 ft (3.6 m) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg or drill elongated holes for fasteners on interior leg as indicated on drawings.

1. Profile: As indicated on Drawings, according to SMACNA's "Architectural Sheet Metal Manual."
2. Fabricate from the Following Materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

   a. Copper: 24 oz./sq. ft. (0.82 mm thick).
   b. Aluminum, Prefinished: 0.050 in (1.25 mm) thick.
   c. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.040 in (1.0 mm) thick.

3. Corners: Factory mitered and mechanically clinched and sealed or soldered watertight.
4. Joints:

   a. Copings 12 Inches Wide or Less: Form butted joints with expansion space and 12 in (300 mm) wide, concealed backup plate with double sealant on each side of joint.
   b. Copings Over 12 Inches Wide: Form joints of intermeshing hooked flanges, not less than 1 in (25 mm) deep, filled with sealant concealed within joints.

C. Roof Expansion-Joint Covers, 2 In (50 mm) and Less: Fabricate cap type expansion cover with continuous flanges to hold cap and serve as counter flashing. Form section not to exceed 12 ft (3.6 m) in length and joint cap sections by standing seams held in place by cleats. Shop fabricate interior and exterior corners. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum, Prefinished: 0.050 in (1.25 mm) thick.
3. Stainless Steel: 0.025 in (0.64 mm) thick.
4. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.034 in (0.8 mm) thick.
5. Joint Style: Standing seam and seal with sealant.
6. Corners: Factory mitered and mechanically clinched and sealed or soldered watertight.

D. Manufactured Roof Expansion Joint Cover Systems:

1. Refer to Division 07 Section "Expansion Joint Cover Assemblies" for manufactured roof expansion joint covers.

E. Counterflashing: Manufactured units of heights to overlap top edges of base flashings by 4 in (100 mm) and in lengths not exceeding 12 ft (3.6 m) designed to snap into through-wall-flashing receiver and compress against base flashings with joints lapped. Shop fabricate interior and exterior corners. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

1. Copper: 16 oz./sq. ft. (0.55 mm thick) .
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
3. Stainless Steel: 0.025 in (0.64 mm) thick.
4. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.
5. Corners: Factory mitered and mechanically clinched and sealed or soldered watertight.
6. Joints: Lapped 4-inches, double seal with sealant.

a. Offset counter-flashing joints 6-inches from flashing receiver joints.

F. Flashing Receivers: Fabricate from same materials as counterflashing.

G. Roof-Penetration Flashing: Fabricate from the following materials:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
3. Stainless Steel: 0.025 in (0.64 mm) thick.
4. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.

H. Pre-Engineered Roof Penetration Housing: Heavy gauge aluminum, pre-insulated, multi-penetration housing assembly with flanged curb and proprietary weather-tight silicone exit seals. Size and configuration as required for number and types of penetrations indicated.

1. Basis of Design: Roof Penetration Housings; Vault AWI Series and Exit Seals.

2.11 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
3. Stainless Steel: 0.025 in (0.64 mm) thick.
4. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.

B. Valley Flashing: Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
3. Stainless Steel: 0.025 in (0.64 mm) thick.
4. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.
5. Joints: Lapped 4-inches, double seal with sealant.

C. Drip Edges: Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
3. Stainless Steel: 0.025 in (0.64 mm) thick.
4. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.
5. Joints: Lapped 4-inches, double seal with sealant.

D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
3. Stainless Steel: 0.025 in (0.64 mm) thick.
4. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.
5. Joints: Lapped 4-inches, double seal with sealant.

E. Counterflashing: Shop fabricate with factory mitered and continuously welded corners, seal watertight. Fabricate from the following materials, minimum thickness as indicated unless required otherwise to meet performance requirements.

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.

3. Stainless Steel: 0.025 in (0.64 mm) thick.
4. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.
5. Joints: Lapped 4-inches, double seal with sealant.

F. Flashing Receivers: Fabricate from same materials as counterflashing.

G. Roof-Penetration Flashing: Fabricate from the following materials:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
3. Stainless Steel: 0.025 in (0.64 mm) thick.
4. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.

2.12 EMBEDDED FLASHING FABRICATIONS

A. Fabricate continuous flashings in sections 8 ft (2.4 m) long minimum, but not exceeding 12 ft (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.

1. Fabricate from the following materials:

a. Stainless Steel: 0.025 in (0.64 mm) thick.

2. Shop form flashing on a bending brake.
3. Shape, trim and hand seam on bench as far as practical with proper tools.
4. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.
5. Form materials to shape indicated with straight lines, sharp angles and smooth curves.
6. Fold and hem exposed edges of flashings.

B. Flashing Joinery: Fabricate interior and exterior corners, intersections, and complex flashing conditions in shop, rather than in field, with properly folded, constructed and mechanicaly fastened continuous soldered joints. Field fabricated units are not permitted and will not be allowed

2.13 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
3. Stainless Steel: 0.025 in (0.64 mm) thick.
4. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.

B. Overhead-Piping Safety Pans: Fabricate from the following materials:

1. Stainless Steel: 0.025 in (0.64 mm) thick.
2. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
3. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.040 in (1.0 mm) thick.

C. Miscellaneous Flashings:

1. Fabricate to cross section indicated with clips and accessories required for secure watertight installation. Meet recommendations of SMACNA for fabrication details and metal thicknesses.
2. Not-Exposed to Public View: Fabricate from the following materials:

a. Copper: 16 oz./sq. ft. (0.55 mm thick).
b. Aluminum, Prefinished: 0.032 in (0.8 mm) thick.
c. Stainless Steel: 0.025 in (0.64 mm).
d. Aluminum-Zinc Alloy-Coated Steel, Prefinished: 0.028 in (0.7 mm) thick.

3. Concealed By other Construction: Fabricate from the following materials:

a. Stainless Steel: 0.025 in (0.64 mm) thick.

D. Pre-Engineered Wall Penetration Panel: Heavy gauge aluminum, multi-penetration wall panel and proprietary weather-tight silicone exit seals. Size and configuration as required for number and types of penetrations indicated.

1. Basis of Design: Roof Penetration Housings; Wall Vault WV Series and Exit Seals.

2.14 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Pitch Pockets (aka Pitch Pans) at Roof Penetrations: Pitch pockets (aka pitch pans) at roofing penetrations are not allowed and will be considered non-conforming work. Refer to the drawings for allowable roof penetration details.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment:

1. Install self-adhering sheet underlayment, wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 in (150 mm) staggered 24 in (600 mm) between courses.
5. Overlap side edges not less than 3-1/2 in (87 mm).
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

B. If recommended by manufacturer, apply slip sheet, wrinkle free, before installing sheet metal flashing and trim at horizontal applications where sheet metal will remain exposed.

1. Install in shingle fashion to shed water.
2. Lap joints not less than 4 inches (100 mm).

3.5 INSTALLATION OF SHEET METAL FLASHING AND TRIM

A. General: Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

   a. Provide uniform, neat seams with minimum exposure of solder and sealant.

3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
5. Install continuous cleats with fasteners spaced not more than 12 in (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
6. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
7. Torch cutting of sheet metal flashing and trim is not permitted.
8. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
3. Asphalt Roofing Cement: Bed flanges in thick coat of asphalt roofing cement where required by manufacturer of sheet metal flashing materials and fabrications for waterproof performance.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. When ambient temperature at time of installation is between 40 deg F and 70 deg F (4 deg C and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
2. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
3. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Sealant Joints: Seal joints as required for watertight construction.

1. Use sealant-filled joints at lap joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pre-tin edges of sheets with solder to width of 1-1/2 in (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.
2. Do not solder metallic-coated steel and aluminum sheet.
3. Do not use torches for soldering.
4. Heat surfaces to receive solder, and flow solder into joint.

a. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

5. Mechanically fasten soldered joints.
6. Stainless-Steel Soldering:

a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
b. Promptly remove acid flux residue from metal after tinning and soldering.
c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

7. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.

H. Rivets: Rivet joints in uncoated metals.

3.6 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with riveted and soldered joints or joints sealed with sealant.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant. Slope to downspouts.
5. Fasten gutter spacers to front and back of gutter.
6. Anchor and loosely lock back edge of gutter to continuous cleat, eave or apron flashing.
7. Anchor gutter with gutter brackets or straps spaced not more than 30 in (750 mm) apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
8. Install gutter with expansion joints at locations indicated, but not exceeding, 50 ft (15.24 m) apart. Install expansion-joint caps.

C. Built-in Gutters:

1. Join sections with riveted and soldered joints or joints sealed with sealant.
2. Provide for thermal expansion.
3. Provide end closures and seal watertight with sealant. Slope to downspouts.
4. Install underlayment layer in built-in gutter trough and extend to drip edge at eaves and under underlayment on roof sheathing.
   a. Lap sides minimum of 2 in (50 mm) over underlying course. Lap ends minimum of 4 in (100 mm).
   b. Stagger end laps between succeeding courses at least 72 in (1800 mm). Fasten with roofing nails.
   c. Install slip sheet over underlayment.
5. Anchor and loosely lock back edge of gutter to continuous cleat.
6. Install gutter with expansion joints at locations indicated, but not exceeding, 50 ft (15.24 m) apart. Install expansion-joint caps.

D. Downspouts:

1. Join sections with 1-1/2-in (38-mm) telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 in (25 mm) from walls. Locate hangers at top and bottom and at approximately 60 in (1500 mm) o.c.
3. Terminate downspouts as indicated on Drawings.
   a. Provide elbows at base of downspout to direct water away from building.
   b. Connect downspouts to underground drainage system.

E. Splash Pans:

1. Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement or elastomeric sealant compatible with the substrate.

F. Parapet Scuppers:

1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Exterior Wall: Anchor scupper closure trim flange to exterior wall and solder or seal with elastomeric sealant to scupper.
3. Exterior Wall and Conductor Head: Loosely lock front edge of scupper with conductor head.
4. Solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

G. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 in (25 mm) below scupper or gutter discharge.

H. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 in (100 mm) in direction of water flow.

3.7 INSTALLATION OF ROOF FLASHING

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

   a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate.
   b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch (600-mm) centers, unless indicated otherwise on Drawings.

3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 in (100 mm) over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 in (100 mm) over base flashing.
3. Lap counterflashing joints minimum of 4 in (100 mm). Secure in waterproof manner by means of anchor and washer at 12 inches (300 mm) o.c. along perimeter and 6 inches (150 mm) o.c. at corners areas centers unless otherwise indicated.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with sealant and clamp flashing to pipes that penetrate roof.

3.8 INSTALLATION OF WALL FLASHING

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 in (100 mm) over top edge of base flashings.

3.9 EMBEDDED FLASHINGS

A. General: Drawings may not necessarily indicate or describe full extent of Work required for completion of embedded flashing.

B. Scheduled Locations: In addition to conditions shown on Drawings, install embedded flashings within cavity at following locations to direct downward flow of infiltrated water within cavity to exterior:

1. Shelf angles with end dams at through-wall openings; and with lap joints.
2. Lintels with end dams or laps.
3. Jambs at through-wall openings, full height from sill to head.
4. Penetrations, parapet terminations into adjacent walls and other wall terminations.
5. Other obstructions.

C. Preparation: Substrate surfaces shall be smooth and free from projections that could puncture flashing.

D. Flashing Installation:

1. Install sheet metal flashing true to line and levels indicated; minimize quantity of lap joints by using longest units possible.
2. Set shaped sheet metal units in proper locations with outside hemmed edges flush with building face location indicated; attach cavity side flanges to sheathed steel stud wall with screw fasteners driven into studs.
3. At continuous shelf angles, terminate horizontal flashings at through-wall openings with properly folded and constructed sheet metal end dams, with continuous soldered joints.
4. At lintels, terminate horizontal flashings at end of lintel with properly folded and constructed sheet metal end dams, with continuous soldered joints.
5. At lap joints of horizontal flashings, form neat and aligned joints by interlocking splice plate within hemmed edge of sheet metal flashing profile; apply sealant and rubberized asphalt flashing as indicated to create water-resistant joint.
6. Set shaped sheet metal units at jambs of through-wall openings and lap inside of end dams at horizontal flashings below; coordinate installation with rigid cavity insulation, if applicable.
7. Seal cavity edges of sheet metal flashings within cavity to sheathing with continuous rubberized asphalt flashing.

E. Examination and Repair: Immediately prior to laying exterior veneer, examine exposed surfaces of flashing and seal penetrations and damaged areas with rubberized asphalt flashing material before covering with exterior veneer.

F. Asphalt Mastic Dampproofing Application: Apply continuous layer of product, without pinholes or holidays, at locations as indicated on drawings. Apply at coverage rate instructed by manufacturer.

1. Repair voids and damage. Patch with additional layer of asphalt mastic dampproofing extending 6 in (150 mm) beyond repaired areas in all directions.

3.10 INSTALLATION OF MISCELLANEOUS FLASHING

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans:

1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
2. Pipe and install drain line to plumbing waste or drainage system.

3.11 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 in in 20 ft (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8 in (3mm) offset of adjoining faces and of alignment of matching profiles.

3.12 FIELD QUALITY CONTROL

A. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

1. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.13 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.14 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

B. Touchup Painting: Clean abraded or damaged areas of shop paint finish and paint exposed areas with the same material used for shop painting. Touchup finish is to match undamaged

finish and extend into retained adjoining finish in a manner that will minimize evidence of touchup.

C. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

3.15 FINISH SCHEDULE

A. Steel Sheet Finishes:

1. Color and Gloss:
2. Color and Gloss: Match Architect's sample.
3. Color and Gloss: As selected by Architect from manufacturer's full range of colors and glosses.
4. Color and Gloss: Match metal roof panels as specified in Division 07 Section "Metal Roof Panels".
5. Color and Gloss: Match color of adjacent building material, contingent upon approval by Architect.

B. Aluminum Sheet Finishes:

1. Color and Gloss:
2. Color and Gloss: Match Architect's sample.
3. Color and Gloss: As selected by Architect from manufacturer's full range of colors and glosses.
4. Color and Gloss: Match metal roof panels as specified in Division 07 Section "Metal Roof Panels".
5. Color and Gloss: Match color of adjacent building material, contingent upon approval by Architect.

3.16

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 077200
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Roof accessories and supplementary items necessary for installation of the following:

1. Roof curbs.
2. Equipment supports.
3. Roof hatches.
4. Heat and smoke vents.
5. Rooftop pipe supports.
6. Precast concrete splash blocks.
7. Snow guards.
8. Snow and ice melt systems.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Indicate dimensions, loadings, and special conditions.

C. Samples for Verification Purposes: Submit for each type of exposed finish required, prepared on Samples in manufacturer's standard sizes, and of same thickness and material indicated for the Work. If finishes involve normal color or shade variations, include sample sets showing the full range of variations expected.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document - Snow and Ice Melt System: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Field Quality Control Reports - Snow and Ice Melt System: Written report of testing and inspection required by "Field Quality Control".

C. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications for Snow and Ice Melt System:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roof accessories to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, and date of manufacture.

B. Protect roof accessories from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

C. Handle, store, and install roof accessories in a manner to avoid permanent deflection of roof deck.

1.8 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.9 WARRANTY

A. Manufacturer's Warranty - Roof Hatches and Smoke Vents: Furnish manufacturer's written material warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge to the Owner.

1. Warranty Period: Manufacturer shall warrant the products to be free from material defects for a period of 5 years from date of Substantial Completion.

B. Manufacturer's Warrant - Snow and Ice Melt System: Furnish manufacturer™™s written material warranty signed by an authorized representative using manufacturer™™s standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Standards: Comply with the following:

1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

2.4 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653 / A 653M, G90 (Z275) coating designation.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792 / A 792M, AZ50 (AZM150) coated.

C. Steel Tube: ASTM A 500, round tube.

D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123 / A 123M.

E. Galvanized Steel Pipe: ASTM A 53/A 53M, hot-dip galvanized according to ASTM A 123 / A 123M.

F. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.

1. Thickness: 20 oz./sf (0.70 mm) nominal.
2. Surface: Smooth and flat.
3. Finish: Finish designations for copper alloys comply with the system defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products".

a. Non-Patinated Finish: Mill.
b. Pre-Patinated Finish: Verdigris pre-patinated according to ASTM B 882.

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Treated Wood Nailers: As specified in Division 06 Section "Miscellaneous Rough Carpentry".

C. Security Grilles: 3/4 in (19 mm) diameter, ASTM A 1011 / A 1011M steel bars spaced 6 in (150 mm) on center in one direction and 12 in (300 mm) on center in the other; factory finished as follows:

1. Surface Preparation: Remove mill scale and rust, if any, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling".
2. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
3. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer; selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats under prolonged exposure.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mils (0.762 mm) thickness per coat.

E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide non-removable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153 / A 153M or ASTM F 2329.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

J. Underlayments:

1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Polyethylene Sheet: 6 mils (0.15 mm) thick polyethylene sheet complying with ASTM D 4397.
3. Slip Sheet: Building paper, 3 lb/100 sf (0.16 kg/sm) minimum, rosin sized.

2.6 ROOF CURBS

A. Insulated Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers:

a. Custom Solution Roof and Metal Products.
b. Pate Company.
c. Roof Products, Inc.
d. Thybar Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.079 in (2 mm) thick. Factory prime coating finish.

D. Construction:

1. Insulation: Manufacturer's standard.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Factory-installed treated wood nailer at top of curb, continuous around curb perimeter.
4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
5. Fabricate curbs to minimum height of 12 in (300 mm) unless otherwise indicated.
6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
8. Security Grille: Provide where indicated.

2.7 EQUIPMENT SUPPORTS

A. Insulated Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers:

a. Custom Solution Roof and Metal Products.
b. Pate Company.
c. Roof Products, Inc.
d. Thybar Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, 0.079 in (2 mm) thick. Factory prime coating finish.

D. Construction:

1. Insulation: Manufacturer's standard.
2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
3. Factory-installed continuous treated wood nailers 3-1/2 in (87 mm) wide at tops of equipment supports.
4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
5. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
6. Fabricate equipment supports to minimum height of 12 in (300 mm) unless otherwise indicated.
7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.8 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers:

a. Acudor Products, Inc.
b. Babcock-Davis.
c. Bilco Company.
d. Dur-Red Products.
e. J.L. Industries, Inc.
f. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
g. Nystrom Building Products.

B. Type and Size: As indicated on Drawings.

C. Loads: Minimum 40 lbf/sf (1.9 kPa) external live load and 20 lbf/sf (0.95 kPa) internal uplift load.

D. Hatch Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.079 in (2 mm) thick.

E. Construction:

1. Insulation: Manufacturer's standard.
2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.

3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
5. Fabricate curbs to minimum height of 12 in (300 mm) unless otherwise indicated.
6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Galvanized-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

1. Provide two-point latch on lids larger than 84 in (2100 mm).

G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 in (1050 mm) above finished roof deck.
3. Material: Steel tube.
4. Post: 1-5/8 in (40 mm) diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat.

H. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.28 requirements and authorities having jurisdiction.

1. Height: 42 in (1050 mm) above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 in (32 mm) in diameter or galvanized-steel tube, 1-5/8 in (40 mm) in diameter.
3. Flat Bar: Galvanized steel, 2 in (50 mm) high by 3/8 in (10 mm) thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 in (525 mm) in diameter.
5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
8. Fabricate joints exposed to weather to be watertight.
9. Fasteners: Manufacturer's standard, finished to match railing system.
10. Finish: Manufacturer's standard.

2.9 HEAT AND SMOKE VENTS

A. Heat and Smoke Vents: Manufacturer's standard, with double-walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed fusible links rated at 165 deg F (74 deg C) and coordinated with fire-suppression and smoke-detection systems.

1. Manufacturers:

a. Acudor Products, Inc.
b. Babcock-Davis.
c. Bilco Company.

d. Dur-Red Products.
e. J.L. Industries, Inc.
f. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
g. Nystrom Building Products.

2. Type and Size: As indicated on the Drawings.
3. Loads: Minimum 40 lbf/sf (1.9 kPa) external live load and 30 lbf/sf (1.4 kPa) internal uplift load.

   a. When release is actuated, lid shall open against 10 lbf/sf (0.5 kPa) snow or wind load and lock in position.

4. Heat and Smoke Vent Standard: Provide units that have been tested and listed to comply with UL 793 and are FMG Approved.
5. Curb, Framing, and Lid Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.079 in (2.01 mm) thick.
6. Construction:

   a. Insulation: Manufacturer standard.
   b. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   c. Exterior Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
   d. Fabricate curbs to minimum height of 12 in (300 mm), unless otherwise indicated.
   e. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
   f. Security Grille: Provide where indicated.

7. Hardware: Manufacturer's standard, corrosion resistant or hot-dip galvanized; with hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.

2.10 ROOFTOP PIPE SUPPORTS

A. Rooftop Supports for Piping, Conduit, Cable Tray or Equipment: Installation without requiring roof penetrations, flashing, or damage to the roofing material. Support bases and pipe rollers made of an engineered thermoplastic with appropriate additives for UV protection. All structural steel components hot-dipped galvanized. Height-adjustable supports must be used where necessary. The support shall have a continuous bottom surface to provide even load distribution and minimize point loading of the roof membrane. Support base to have radiused edge to enhance compatibility with roof membranes.

   1. Load Capacity: Up to 1,500 lbs (680 kg).

B. The rooftop strut support shall provide a fixed-height mounting platform of 4 or 6 inches (100 or 150 mm) off of the roof and a usable strut length of up to 10 or 16 inches (250 or 400 mm).

C. The adjustable-height strut support shall allow elevations changes of up to 16 inches (400 mm) off of the roof and a usable strut length of up to 10 or 16 inches (250 or 400 mm).

D. The rooftop roller support shall provide roller capacity for up to nominal 6 inches (150 mm) steel pipe with a minimum 5-1/2 inches (138 mm) fixed height off of the roof.

E. The adjustable-height roller support shall provide roller capacity for up to nominal 6 inches (150 mm) steel pipe and accommodate elevation changes of up to 16 inches (400 mm) off of the

roof. The rollers shall be polymeric. The roller axle, fittings and other hardware shall be manufactured of hot-dipped galvanized steel.

F. Basis of Design: ERICO International Corporation; ST Series, Strut-based Thermoplastic Supports.

2.11 PRECAST CONCRETE SPLASH BLOCKS

A. Prefabricated units of reinforced Portland cement concrete, aggregates, admixtures, and water; shaped to divert water away from building. Minimum size: 12 in (300 mm) by 24 in (600 mm) by 3 in (75 mm) high. Weight: 50 lbs (22.6 kg). Provide protection layer below splash block to protect roofing system.

2.12 SNOW GUARDS

A. Snow Guards, General: Prefabricated, noncorrosive units designed to be installed without penetrating roofing system; complete with predrilled holes, clamps, or hooks for anchoring. Snow guards materials and mounting method shall be fully compatible with adjacent roofing system to avoid any damage or penetrations which may compromise the integrity of the system.

B. Surface-Mounted, Plastic, Stop-Type Snow Guards: Clear polycarbonate stops designed for attachment to panel surface of roofing system using construction adhesive, silicone or polyurethane sealant, or adhesive tape.

C. Surface-Mounted, Metal, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to panel surface of roofing system using construction adhesive, silicone or polyurethane sealant, or adhesive tape.

D. Seam-Mounted, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to vertical ribs of standing-seam sheet metal roofing with stainless-steel set screws.

E. Seam-Mounted, Bar-Type Snow Guards: Rail- or fence-type assembly consisting of mill-finished aluminum or stainless-steel rods, bars, or pipe held in place by stainless-steel clamps attached to vertical ribs of standing-seam sheet metal roofing.

F. Surface-Mounted, Copper, Stop-Type Snow Guards: Bronze-alloy stops designed for attachment to panel surface of copper roofing using solder.

G. Manufacturers:

1. Alpine SnowGuards, a division of Vermont Slate & Copper Services, Inc.
2. Berger Building Products.
3. Chemlink, Inc.
4. LMCurbs
5. Polar Blox.
6. Precision Molding Co., Inc.
7. Snoblox / Snojax Inc.
8. Sno-Gem, Inc.
9. TRA Mage Inc.
10. Zaleski Snow-Guards & Roofing Specialties

2.13 SNOW AND ICE MELT SYSTEMS

A. Basis of Design: Bylin Engineered Systems; Roof Ice Melt "RIM" Eave, Rake, and Valley Panels.

1. Description: Metal cover panels with 3 runs of heating cables at eaves and 2 runs of heating cables at valleys and rakes.
2. Snow Load Accumulation Area Rating: Class 1.

3. Metal Cover Panel Material: 20 oz./sq. ft. (0.68 mm thick).
4. Metal Cover Panel Material: 0.040 inches (1 mm) thick aluminum with Fluoropolymer finish, match sample accepted by Architect.

B. Basis of Design: Bylin Engineered Systems; Roof Ice Melt "RIM2" Eave, Rake, and Valley Panels.

1. Description: Metal cover panels with 3 runs of heating cables at eaves and 2 runs of heating cables at valleys and rakes.
2. Snow Load Accumulation Area Rating: Class 2.
3. Metal Cover Material: 20 oz./sq. ft. (0.68 mm thick).
4. Metal Cover Material: 0.040 inches (1 mm) thick aluminum with Fluoropolymer finish, match sample accepted by Architect.

C. Heating Cables: Manufacturer's standard heating cables specifically designed for snow and ice melting. The heating cable shall be capable of varying its heat output along its entire length. The heating cable shall be specifically listed by UL as electric roof and gutter de-icing and snow-melting equipment.

D. Control Panel: Manufacturer's standard control system including control panel complete with branch circuit protection, ground fault protection, ambient temperature controller, temperature controllers, solid state relays, terminal blocks, switches, power on light, and all necessary accessories.

E. Junction Box / Power Termination: The heating cable circuits shall be connected to the power wiring in an accepted junction box with accepted termination components.

2.14 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

2.15 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

1. Color and Gloss: As selected by Architect from manufacturer's full range.
2. Color: As scheduled or as indiciated in Design Selections.

C. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF ROOF ACCESSORIES

A. General: Install and securely anchor roof accessories directly to structural supporting deck or substrate (not on top of wood blocking) so they are capable of resisting indicated loads.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
3. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous paint or by other permanent separation as recommended by manufacturer.

1. Underlayments: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level, unless otherwise indicated.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Roof-Hatch Installation:

1. Install roof hatch so top surface of hatch curb is level, unless otherwise indicated.

2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
3. Attach safety railing system to roof-hatch curb.
4. Attach ladder-assist post according to manufacturer's written instructions.

F. Heat and Smoke Vent Installation:

1. Install heat and smoke vent so top perimeter surfaces are level.
2. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.

G. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

H. Rooftop Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Provide complete and adequate support of all piping and conduit, whether or not all required devices are shown.
2. The use of wood for supporting piping is NOT permitted.
3. Provide supports spaced so deflection of piping does not exceed 1/240 of span.
4. Isolation Pads: Consult manufacturer of existing or new roofing system as to the type of isolation pads required between the roof and support. Set isolation pads in adhesive if required by manufacturer's instructions. Place supports on isolation pads.

I. Precast Concrete Splash Blocks: Install splash block at outlet locations of downspouts. Set splash block over protection layer to protect roofing system.

J. Stop-Type Snow Guards: Attach snow guards to roofing system with adhesive or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate roofing system. Install snow guards in layout, spacing, and pattern indicated on the Drawings.

K. Bar-Type Snow Guards: Attach bar supports to vertical ribs of metal roofing system with clamps or set screws. Do not use fasteners that will penetrate roofing system. Install snow guards in layout, spacing, and pattern indicated on the Drawings.

L. Snow and Ice Melt Systems: Install in accordance with manufacturer's written installations at layout, spacing, pattern and locations indicated on the Drawings. Coordinate the complete snow and ice melt system installation with the gutter, roofing, and flashing installations.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service - Snow and Ice Melt System: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.6 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Clean off excess sealants.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

E. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 09 painting Sections.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 078116
SPRAYED FIRE-RESISTIVE MATERIALS (SFRM)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sprayed fire-resistive materials (SFRM) and supplementary items necessary for installation.

1.2 DEFINITIONS

A. SFRM: Sprayed Fire-Resistive Materials.

B. Concealed: Not visible; hidden by other construction.

C. Exposed: Visible, not hidden by other construction.

D. Direct Moisture: Exposed to wetness, surfaces normally soaked, saturated or regularly exposed to water and or moisture.

1.3 ACTION SUBMITTALS

A. Fire-Rated Assembly Design Classification: Submit documentation issued by testing agency for each fire-rated assembly design selected.

B. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

a. Sprayed fire-resistive materials.
b. Substrate primers.
c. Bonding agent.
d. Metal lath.
e. Reinforcing fabric.
f. Reinforcing mesh.
g. Sealer and topcoats when applicable.

C. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work.

1. Framing plans and schedules indicating the following.

a. Extent of fire protection for each construction and fire-resistance rating.
b. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
c. Minimum sprayed fire-resistive material thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.

1) Requirements for steel surface preparation.

d. Treatment of sprayed fire-resistive material after application.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1. Product Certificates: For each type of sprayed fire-resistive material.

B. Evaluation Reports: For sprayed fire-resistive material, from ICC-ES.

C. Preconstruction Test Reports: For fire protection.

D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

E. Warranty:

1. Provide manufacturer written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test reports indicating compliance with requirements for specified performance and test methods.

1. Bond Strength: Test for cohesive and adhesive strength in accordance with ASTM E736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with sprayed fire-resistive material.
3. If additional testing is required, schedule sufficient time for testing and analyzing results to prevent delaying the Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
   1) Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.
   2) Review written patching plan detailing materials and methods used for patching fire-resistive materials damaged during construction.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply fire protection when ambient temperature, substrate temperature, and moisture conditions are within range established and recommended by manufacturer. Provide temporary protection and heat to maintain temperature for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

A. Installer’s Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer’s standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to the following:
   a. Defects or deterioration.
   b. Cracking, flaking, or spalling.
   c. Peeling or delaminating from substrates.
   d. Failure to remain bonded.
   e. Erosion in excess of specified requirements.
   f. Faulty application.

2. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Assemblies: Provide fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.

1. Obtain fire protection materials for each fire-resistance design from single source.

C. Material Compatibility: Primer and sprayed fire-resistive materials shall be compatible with one another and with substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and laboratory analysis.

D. Fire-Resistance Design: Indicated on Drawings, tested in accordance with ASTM E119 or UL 263; testing by a qualified testing agency or listing of other testing agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Steel members are considered unrestrained unless indicated otherwise.

E. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 10 or less.
2. Smoke-Developed Index: 10 or less.

F. Asbestos: Provide products containing no detectable asbestos.

2.4 SPRAYED-FIRE RESISTIVE MATERIALS

A. Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design.

1. Products mixed with water at Project site to form a slurry or mortar before conveyance and application

B. Bond Strength: Minimum cohesive and adhesive strength based on field testing in accordance with ASTM E736.

1. Buildings up to 75 ft (22.8 m) in Height: 150-lbf/sq. ft. (7.18-kPa).

2. Buildings more than 75 ft (22.8 m) up to 420 ft (128 m) in Height: 430-lbf/sq. ft. (20.59-kPa).
3. Buildings more than 420 ft (126 8) in Height: 1000-lbf/sq. ft. (47.88-kPa).

C. Density: Not less than density specified in the approved fire-resistance design, in accordance with ASTM E605.

1. Low-Density – Gypsum Binder: 15 pcf (240 k/cu m).
2. Medium-Density - Gypsum Binder: 18 pcf (288 k/cu m).
3. Medium-Density – Cement Binder: 22 pcf (352 k/cu m).
4. High-Density – Cement Binder: 40 pcf (640 k/cu m).

D. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 0.375 inch (9 mm).

E. Combustion Characteristics: ASTM E136.

F. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.

G. Deflection: No cracking, spalling, or delamination according to ASTM E 759.

H. Effect of Impact on Bonding: No cracking, spalling, delamination, per ASTM E 760.

I. Air Erosion: Maximum weight loss of 0.025 grams per square foot in 24 hours according to ASTM E 859.

J. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G21.

K. Signal Color for Renovation Work: Incorporate dye in mix to distinguish new work from existing coated surfaces.

L. SFRM-01 - Low-Density; minimum bond strength of 150-lbf/sq. ft. (7.18-kPa).

1. Interior Locations: Unless a higher bond strength SFRM is scheduled below.

a. Concealed conditions for Buildings up to 75 ft (22.8 m) in height.

2. Manufacturers and Products:

a. Carboline Co., Fireproofing Products Div.; Pyrolite 15 or Pyrolite 15 High-Yield.
b. GCP Applied Technologies; Monokote MK-6.
c. Isolatek International; Cafco 300 or Cafco 300 AC.

M. SFRM-02:

1. Interior Locations: Unless a higher bond strength SFRM is scheduled below.

a. Concealed conditions for Buildings more than 75 ft (22.8 m) up to 420 ft (128 m) in height.
b. Exposed conditions for Buildings up to 420 ft (128 m) in height.

2. Low-Density; minimum bond strength of 430-lbf/sq. ft. (20.59-kPa):

a. Grace Construction Products; Monokote MK-10HB.
b. Isolatek International; Cafco 300HS.

3. Medium Density; minimum bond strength of 430-lbf/sq. ft. (20.59-kPa):

a. Carboline Co., Fireproofing Products Div.; Pyrolite 22.

b. Grace Construction Products; Monokote Z106G.
c. Isolatek International; Cafco 400 AC.
d. Southwest Vermiculite Co., Inc.; Type 5MD.

N. SFRM-03:

1. Interior Locations: Unless a higher bond strength SFRM is scheduled below.

a. Concealed conditions for Buildings more than 420 ft (126 8) in height.
b. Exposed conditions for Buildings more than 420 ft (126 8) in height.

2. Medium-Density; minimum bond strength of 1000-lbf/sq. ft. (47.88-kPa):

a. Carboline Co., Fireproofing Products Div.; Type 7GP.
b. GCP Applied Technologies; Monokote Z106/HY or MK-1000HB.
c. Isolatek International; Cafco 400 or Cafco 3000.
d. Southwest Fireproofing Products Co., Inc.; Type 7GP.

O. SFRM-04 - Medium Density, Portland Cement Binder; minimum bond strength of 1000-lbf/sq. ft. (47.88-kPa):

1. Interior Locations: Unless a higher bond strength SFRM is scheduled below.

a. Exposed columns.
b. Exposed structure in mechanical/electrical rooms and elevator shafts.
c. Exposed conditions subject to abrasion or humidity.

2. Manufacturers and Products:

a. Carboline Co., Fireproofing Products Div.; Pyrolcrete 239.
b. GCP Applied Technologies; Monokote Z106/HY.
c. Isolatek International; Cafco 400.
d. Southwest Fireproofing Products Co., Inc.; Type 7GP.

P. SFRM-05 - High-Density, Portland Cement Binder; minimum bond strength of 10000-lbf/sq. ft. (478.8-kPa).

1. Interior or Exterior Locations:

a. Exterior conditions.
b. Exposed conditions subject to impact or direct moisture.

2. Manufacturers and Products:

a. Carboline Co., Fireproofing Products Div.; Pyrocrete 40.
b. GCP Applied Technologies; Monokote Z146.
c. Isolatek International; Fendolite M-II.
d. Southwest Vermiculite Co., Inc.; 7HD.

Q. SFRM-R - Low-Density; minimum bond strength of 150-lbf/sq. ft. (7.18-kPa):

1. Interior Locations:

a. Renovation work and previously coated surfaces for Buildings up to 75 ft (22.8 m) in height.

2. Manufacturers and Products:

a. Carboline Co., Fireproofing Products Div.; Retrolite 15.
b. GCP Applied Technologies; Retro-Guard RG.
c. Isolatek International; Cafco 300 SB.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with sprayed fire-resistive material and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by sprayed fire-resistive material manufacturer and complying with one or both of the following requirements:

1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Primer's bond strength in required fire-resistance design complies with specified bond strength for sprayed fire-resistive material and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests in accordance with ASTM E736.

C. Bonding Agent: Product approved by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, in accordance with fire-resistance designs indicated and sprayed fire-resistive material manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by sprayed fire-resistive material manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by sprayed fire-resistive material manufacturer. Include pins and attachment.

G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.

H. Topcoat: Suitable for application over sprayed fire-resistive material; of type recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.

1. Cement-Based Topcoat: Factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.
2. Water-Based Permeable Topcoat: Factory-mixed formulation for brush, roller, or spray application over applied SFRM.

I. Patching Material: Product provided by fire-resistive materials manufacturer for patching damaged work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.

B. Verify that concrete work on steel deck is complete before beginning Work.

C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning Work.

D. Conduct tests in accordance with sprayed fire-resistive material manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Cover other work subject to damage from fallout or overspray of fire protection materials during application.

C. Clean substrates of substances that could impair bond of fire protection.

D. Prime substrates where included in fire-resistance design and where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.

1. If paint or primer is incompatible as determined by sprayed fire-resistive material manufacturer and must be removed or repaired, provide additional materials at no cost to the Owner.

E. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire

protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.4 APPLICATION

A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fire protection Work.

B. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection as applicable to specific conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.

1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.

D. Metal Decks:

1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, is completed.
2. Do not apply fire protection to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fire protection.

E. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and sprayed fire-resistive material manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer.

F. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

G. Extend fire protection in full thickness over entire area of each substrate to be protected.

H. Install body of fire protection in a single course unless otherwise recommended in writing by sprayed fire-resistive material manufacturer.

I. Where sealers are used, apply products that are tinted to differentiate them from fire protection over which they are applied.

J. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.

K. Cure fire protection in accordance with sprayed fire-resistive material manufacturer's written instructions.

L. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.

M. Finishes: Apply fire protection to produce finishes in accordance with manufacturer's written instructions for each finish selected.

1. Spray-Textured Finish: Finish left as spray applied with no further treatment.

2. Rolled, Spray-Textured Finish: Where indicated, even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
3. Skip-Troweled Finish: Where indicated, even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.
4. Skip-Troweled Finish with Corner Beads: Where indicated, even, leveled surface produced by troweling spray-applied finish to smooth out the texture, eliminate surface markings, and square off edges.

N. Patching: Under the following conditions, remove sprayed fire-resistive materials and re-apply same sprayed fire-resistive materials as used for original application, or apply patching material:

1. Portions damaged, abraded, or removed by subsequent building construction.
2. Previously applied materials determined by testing and inspection agency to be noncompliant.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Special Inspections: Owner will engage a qualified special inspector to perform special inspections and prepare reports as required by the Building Code and Authorities Having Jurisdiction:

1. Installation of sprayed fire-resistive materials.
2. Testing agency will report test results promptly and in writing to Contractor and Architect.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
2. Correction of Deficiencies:

   a. Materials and installation will be considered defective if they do not meet specified requirements.
   b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
   c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3. Prepare test and inspection reports.

3.6 CLEANING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.7 PROTECTION

A. Protect fire protection, in accordance with advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

1. Prevent deterioration of fire-resistive materials due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.

3.8 REPAIRS

A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.

B. Repair fire protection damaged by other work before concealing it with other construction.

C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 078413
PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes penetration firestopping systems for openings and penetrations through smoke and fire-resistance-rated assemblies, and supplementary items necessary to complete their installation.

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency..

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

B. Environmental Limitations: Do not install firestopping systems when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

C. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestopping systems.

D. Notify Owner's inspecting agency at least seven days in advance of firestopping system installations; confirm dates and times on days preceding each series of installations.

E. Do not cover up firestopping system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Acceptable Manufacturers: Manufacturer is “acceptable□if firestopping system has been tested and listed by UL or other testing and inspection agency acceptable to authorities having jurisdiction and manufacturer can evidence product compliance with requirements of the Contract Documents.

1. FM Global: Manufacturer to provide firestopping products in compliance with FM Global requirements as indicated in "Quality Assurance" Article.

B. Compatibility: Provide firestopping systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping systems, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.

C. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials and approved by the qualified testing and inspection agency for firestopping systems indicated.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Assemblies: Provide firestopping systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

C. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency acceptable to authorities having jurisdiction.

1) UL Fire Resistance Directory.
2) Intertek Group Directory of Listed Building Products.
3) FM Global Building Materials Approval Guide.

2.3 PENETRATION FIRESTOP SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Classified in Underwriters Laboratories (UL) Fire Resistance Directory, Section XHEZ - Penetration Firestop System", and/or Section XHHW - Fill Void or Cavity Materials for specific project conditions.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

a. Penetrations located outside wall cavities.
b. Penetrations located outside fire-resistive shaft enclosures.
c. Penetrations located in construction containing fire-protection-rated openings.

3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.

E. Penetrations in Fire-Resistance-Rated Smoke Barriers: In addition to penetration firestopping systems with L-Ratings determined per UL 1479, provide F-Ratings and T-Ratings determined per ASTM E 814 or UL 1479.

F. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.4 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

K. Additional Application Requirements:

1. Firestops exposed to view and/or are scheduled to receive finishes shall be paintable or capable of receiving finish materials.

2. Firestops exposed to traffic, moisture, and physical damage shall be products that do not deteriorate when exposed to these conditions.
3. Firestops for water piping penetrations, of any type, shall be moisture-resistant products.
4. Firestops for floor penetrations with annular spaces exceeding 4 in (100 mm) or more in width and exposed to possible loading and traffic shall be products capable of supporting the floor loads involved either by installing floor plates or by other means.
5. Firestops for penetrations involving insulated piping shall be products that do not require removal of insulation.
6. Firestops for cable trays and future penetrations shall be reusable pillows or bags.

L. Provide firestops within fire resistive walls and partitions containing flush mounted devices such as outlet boxes, electrical cabinets and mechanical cabinets mounted back to back and spaced less than 24 inches on center in accordance with UL Fire Resistance Directory "Wall Opening Protective Materials", Category CLIV.

2.5 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Surface Cleaning: Before installing fire-resistive penetration systems, clean penetrations immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements.

1. Remove foreign materials from surfaces of openings, joints and penetrating items that could interfere with adhesion of firestopping.
2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.

C. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently

stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.4 INSTALLATION OF PENETRATION FIRESTOPS

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials for penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Tested System or Engineered Judgement Number.
4. Date of installation.

5. Manufacturer's name.
6. Installer's name.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Special Inspections: Owner will engage a qualified special inspector to perform special inspections and prepare reports as required by the Building Code and Authorities Having Jurisdiction according to ASTM E 2174:

1. Installation of penetration firestopping.
2. Testing agency will report test results promptly and in writing to Contractor and Architect.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.7 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping system products and of products in which opening and joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 078446
FIRE RESISTIVE JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes firestopping systems for joints at perimeter and through smoke and fire-resistance-rated assemblies, and supplementary items necessary to complete their installation.

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

C. Compatibility and Adhesion Testing: Manufacturer of fire stopping material shall be responsible for testing samples of materials that will contact or affect firestopping materials.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of fill materials to joint substrates.
2. Perform tests under environmental conditions replicating those that will exist during installation.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain fire-resistant joint sealants manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

B. Environmental Limitations: Do not install firestopping systems when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

C. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

C. Coordinate sizing of joints to accommodate joint firestopping systems.

D. Notify Owner's inspecting agency at least seven days in advance of firestopping system installations; confirm dates and times on days preceding each series of installations.

E. Do not cover up firestopping system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Acceptable Manufacturers: Manufacturer is "acceptable" if firestopping system has been tested and listed by UL or other testing and inspection agency acceptable to authorities having jurisdiction and manufacturer can evidence product compliance with requirements of the Contract Documents.

1. FM Global: Manufacturer to provide firestopping products in compliance with FM Global requirements as indicated in "Quality Assurance" Article.

B. Compatibility: Provide firestopping systems that are compatible with one another and the substrates forming openings, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.

C. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials. Use only components specified by firestopping system manufacturer and approved by the qualified testing and inspecting agency for firestopping systems indicated.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Assemblies: Provide firestopping systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gasses.

C. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory.
2) Intertek Group in its Directory of Listed Building Products.
3) FM Global in its "Building Materials Approval Guide.

2.3 JOINT FIRESTOPPING SYSTEMS.

A. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.

1. F-Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

B. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.

1. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).

1. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

F. Joints, required for control of movement, at intersection between Rated Wall Assemblies and Nonrated Horizontal Assemblies: Provide joint firestopping with ratings determined by ASTM E 2837.

G. Perimeter Fire Containment System: Provide systems for establishment of a fire resistive barrier at the portion of perimeter exterior wall (spandrel) that is adjacent to edge of structural floor or roof slabs, which provides and maintains a resistance to the passage of fire from one floor to the floor above. Provide fire resistive rating with movement capabilities equaling or exceeding the rating of the adjacent floor or roof assembly, as determined by ASTM E 2307.

1. Integrity Rating: Measure of system's ability to withstand fire exposure without permitting passage of flame through openings or occurrence of flaming on any element of the unexposed surface of the fill material or floor or on the interior surface of the wall above the fill material.
2. Expansion and Contraction: Perimeter fire containment systems shall accommodate movement of the exterior wall due to thermal expansion and contraction.

2.4 TOP-OF-WALL JOINT FIRESTOPPING

A. Safing Insulation: Semi rigid board insulation produced by combining slag-wool fibers with thermosetting resin binders and complying with the following:

1. ASTM C 612, Type 1A and 1B.
2. Nominal density of 4 lb/cu. ft.
3. ASTM E119 Fire rating indicated, but not less than 2 hours.

B. Coating Material: Manufacturers standard fill material or spray applied product for sealing surface of safing insulation and adjacent construction against penetration of fire and smoke.

C. Fire Resistive Sealants: Intumescent single-component, water based, high solids, elastomeric sealants. Nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant.

2.5 PERIMETER FIRE CONTAINMENT SYSTEM - EDGE OF SLAB

A. Safing Insulation: Semi rigid board insulation produced by combining slag-wool fibers with thermosetting resin binders and complying with the following:

1. ASTM C 612, Type 1A and 1B.
2. Nominal density of 4 lb/cu. ft.
3. ASTM E119 Fire rating indicated, but not less than 2 hours.

B. Coating Material: Manufacturers standard fill material or spray applied product for sealing surface of safing insulation and adjacent construction against penetration of fire and smoke.

2.6 PERIMETER FIRE CONTAINMENT SYSTEM - GLAZED ALUMINUM FRAMING SYSTEMS

A. Curtainwall Insulation and Mullion Cover: Semi-rigid board insulation produced by combining slag-wool or rock-wool fibers with thermosetting resin binders, aluminum foil scrim backing, and complying with the following:

1. ASTM C 612, Type 3.
2. Nominal density of 8 and 4 lb/cu. ft. as required by test assembly.
3. ASTM E 119 fire rating as indicated, but not less than 2 hours.

B. Safing Material: Semi-rigid board insulation produced by combining slag-wool fibers with thermosetting resin binders, unfaced, and complying with to the following:

1. ASTM C 612, Type IA and IB.
2. Nominal density of 4 lb/cu. ft.
3. ASTM E 119 fire rating as indicated, but not less than 2 hours.

C. Coating Material: Manufacturer's standard fill material or spray applied product for sealing top of safing material.

D. Impaling Pins: 12 gage steel pins swaged to galvanized steel angles for screw attachment to glazed aluminum wall system aluminum framing.

E. Reinforcing Angles: Galvanized steel angles of size, thickness, and finish suitable for application.

F. Curtainwall Insulation Tape: Manufacturer's standard pressure sensitive aluminum foil faced tape product for taping curtainwall insulation joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions

3.2 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove foreign materials from surfaces of joints that could interfere with adhesion of firestopping.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.

C. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION - GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.4 INSTALLATION OF FIRE-RESISTANT JOINT SEALANTS

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 INSTALLATION OF FIRE SAFING PROTECTION

A. Top of Wall: Install safing insulation to fill gap between top of wall and floor slab above. Cut safing insulation 50 percent wider than gap to be filled to ensure compression fit.

3.6 INSTALLATION OF PERIMETER FIRE CONTAINMENT SYSTEM

A. Edge of Slab:

1. Edge of Slab: Install safing insulation to fill gap between edge of structural floor/roof slab and back of exterior wall on safing clips spaced as needed to support insulation but not further apart then 24 in (600 mm) o.c. unless not required by tested system. Cut safing insulation 50 percent wider than gap to be filled to ensure compression fit or install vertically as required by tested assembly.
2. Install coating material or smoke seal compound to cover fill material and seal opening.

B. Glazed Aluminum Framing Systems:

1. Install system to extend the required vertical distance above and below the structural floor/roof slab but not less than to next horizontal mullion.
2. Attach impaling pins to glazed aluminum wall framing, using screws, at corners and around perimeter of glazed unit. Install curtainwall insulation material over impaling pins so that the edges are tight fitting against the aluminum frame and the face of material will be flush with the aluminum frame. Secure units with clinch shields over impaling pins.

Locate horizontal seams in the curtainwall insulation material, 6 in (150 mm) from top of joint and provide supporting angles as required.

3. Install safing material in the joint between the interior face of aluminum frame (and face of curtainwall insulation material) and the edge of the structural floor or roof slab. Compression fit safing material 50 percent, or as required by tested assembly, into spaces between floor slab and mounting angles. Provide safing clips to support safing material if required by tested system. Install coating material or smoke seal over safing material flush with top of floor/roof slab.
4. Install mullion covers centered over horizontal and vertical aluminum frames within barrier area using the same impaling pins as used to attach the curtainwall insulation material. Secure covers with clinch shields over impaling pins.
5. Install curtainwall insulation tape to seal all meeting edges of insulation with tape centered over the junction of adjacent insulation and all meeting edges of insulation and framing members so that approximately 2 in (50 mm) of tape covers each edge of the adjacent material.

3.7 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Tested System or Engineered Judgment Number.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Special Inspections: Owner will engage a qualified special inspector to perform special inspections and prepare reports as required by the Building Code and Authorities Having Jurisdiction according to ASTM E 2393:

1. Installation of penetration firestopping.
2. Testing agency will report test results promptly and in writing to Contractor and Architect.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.

b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.9 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping system products and of products in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 079200
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Joint sealants, backing materials, and supplementary items necessary for installation.

B. Related Requirements:

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Samples for Verification Purposes: Samples for each kind and color of joint sealants in 1/2 in (12 mm) wide joints formed between two 6 in (150 mm) long strips of material matching appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation, primers and backers.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

C. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

D. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

E. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

F. Warranties:

1. Provide manufacturer's and installer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Sealant, Waterproofing and Restoration Institute (SWRI) Validation Certificate: Each sealant shall be validated by SWRI Sealant Validation Program.

D. Mock-Ups: Before beginning Work of this Section, install joint sealants in mock-ups of the various assemblies specified in other Sections indicated to receive joint sealants specified in this Section. Mock-ups shall include each form of product and color required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1.5 PRECONSTRUCTION TESTING

A. Pre-Construction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint urethane and silicone sealants:

1. General Requirements: Test materials forming joint substrates and joint sealant backings for compatibility and adhesion with joint sealants.
2. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
3. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
4. Specimen Quantity: Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.

   a. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

5. Reports: Interpret test results and certify reports indicating requirements for primers and substrate preparation needed.

   a. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primer.

6. Equivalent Option to Testing: Testing may not be required if joint-sealant manufacturers submit joint preparation data based on previous testing, not older than 12 months, of sealant products for adhesion to and compatibility with joint substrates and other materials matching those submitted.

B. Pre-Construction Stain Testing: Submit samples of joint substrate materials that will contact or affect urethane and silicone joint sealants to respective joint sealant manufacturers for following testing:

1. General Requirements: Test materials forming joint substrates for resistance to staining caused by joint sealants.
2. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with substrates, including stone and stone masonry.
3. Specimen Quantity: Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.

   a. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. Reports: Interpret test results and certify reports indicating whether joint sealants stain substrate materials.

   a. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures.

5. Equivalent Option to Testing: Testing may not be required if joint-sealant manufacturers submit joint preparation data based on previous testing, not older than 12 months, of sealant products for staining joint substrates and other materials matching those submitted.

C. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.

   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 PROJECT CONDITIONS

A. Ambient Conditions: Install joint sealants within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer. Protect substrates from environmental conditions that affect performance.

1. Do not apply to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

B. Weather Conditions Limitation: Proceed with Work only when existing and forecasted weather conditions will permit installation according to manufacturer's instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Manufacturer's Warranty for Urethane Sealants: Furnish manufacturer's written material warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material Defects for a period of 5 years from date of Substantial Completion.

B. Manufacturer's Warranty for Silicone Sealants: Furnish manufacturer's written material warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material Defects for a period of 20 years from date of Substantial Completion.

C. Installer's Warranty: Furnish installer's written warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the products to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Suitability for Contact with Food: Comply with authorities having jurisdiction for joints in repeated contact with food.

C. Sealant Color: As scheduled or as indicated in Design Selections.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Material Compatibility: Joint sealants, backings, and other related materials shall be compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.

2.4 EXTERIOR ELASTOMERIC SEALANTS

A. Exterior Pourable Urethane Sealant:

1. Product Quality Standard: ASTM C 920, Type M, Grade P, Class 25, Use T.
2. Description: Multi-component, pourable, moisture curing, polyurethane sealant; rated for incline when used on sloped surfaces.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:

a. Sika Corp.; Sikaflex SL 2.
b. Pecora Corp.; Urexpan NR-200.
c. Sika Corp., Construction Products Div.; Sikaflex 2c SL.
d. Tremco Commercial Sealants & Waterproofing; THC-900/THC-901 or Vulkem 445SSL.

B. Exterior Non-sag Silicone Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 50 or 100/50.
2. Description: Single component, non-sag, neutral cure, non-staining as determined by pre-construction stain testing, and non-bleeding, silicone sealant.
3. Joint Movement Capability:

   a. Class 50: Plus 50 percent, minus 50 percent.
   b. Class 100/50: Plus 100 percent, minus 50 percent.

4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:

   a. Class 50:

      1) Dow; DOWSIL 795 Silicone Building Sealant.
      2) Momentive Performance Materials, GE Silicones; Silpruf SCS2000.
      3) Pecora Corp.; 864NST.
      4) Sika Corp., Construction Products Div.; Sikasil WS-295.
      5) Tremco Commercial Sealants & Waterproofing; Spectrem 3.

   b. Class 100/50:

      1) Dow; DOWSIL 790 Silicone Building Sealant.
      2) Momentive Performance Materials, GE Silicones; Silpruf LM SCS2700.
      3) Pecora Corp.; 890NST.
      4) Sika Corp., Construction Products Div.; Sikasil WS-290.
      5) Tremco Commercial Sealants & Waterproofing; Spectrem 1.

C. Exterior Air and Water Barrier Silicone Sealant:

1. Description: One part, neutral cure silicone sealant, designed for adhering to low energy surfaces commonly found on sheet air and water barriers.
2. Manufacturers and Products:

   a. Basis of Design: Dow Corning; Dowsil 758 Silicone Weather Barrier Sealant.

D. Exterior Non-Sag Urethane Sealant for Precast Concrete Seating Bowl:

1. ASTM C 920, Type M, Grade NS, Class 25.
2. Two-part, non-sag, polyurethane rubber sealant. Joint movement capability of +50 percent, -50 percent
3. Acceptable manufacturers and product:

   a. BASF; MasterSeal NP 2 (Formerly Sonolastic NP 2).
   b. Pecora Corp.; Dynatrol II.
   c. Sika Corp., Construction Products Div.; Sikaflex 2c NS
   d. Tremco Inc.; Dymeric 240 FC.

2.5 INTERIOR ELASTOMERIC SEALANTS

A. Interior Non-sag Silicone Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25.
2. Description: Single component, non-sag, moisture curing, silicone sealant specially formulated with fungicide for use in sanitary non-porous applications.
3. Manufacturers and Products:

   a. Dow; DOWSIL 786 Silicone Sealant.
   b. Momentive Performance Materials, GE Silicones; Sanitary SCS1700.
   c. Pecora Corp.; 898.

d. Sika Corp., Construction Products Div.; Sikasil GP
e. Tremco Commercial Sealants & Waterproofing; Tremsil 200.

B. Interior Non-sag Urethane Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25 or 35.
2. Description: Single component, non-sag, moisture curing, non-staining as determined by pre-construction stain testing if exposed, polyurethane sealant.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent, or plus 35 percent, minus 35 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:

a. Sika Corp.; Sikaflex NP 1.
b. Pecora Corp.; Dynatrol I-XL.
c. Sika Corp., Construction Products Div.; Sikaflex 1a or Sikaflex Textured Sealant.
d. Tremco Commercial Sealants & Waterproofing; Dymonic or Vulkem 116.

C. Interior Non-sag Acrylic Latex Sealant:

1. Product Quality Standard: ASTM C 834, Type and Grade as required by conditions.
2. Description: Single component, non-sag, moisture curing, general purpose, paintable, siliconized acrylic latex sealant.
3. Joint Movement Capability: Plus 7.5 percent, minus 7.5 percent
4. Manufacturers and Products:

a. Pecora Corp.; AC 20+.
b. Tremco Commercial Sealants & Waterproofing; Tremflex 834.

D. Sprayed Foam Insulating Gap Filler:

1. Description: Low pressure, one-component, expanding, open-cell latex-based insulating foam gap filler; applied with professional hand-held dispensing gun; CFC and HCFC free.
2. Performance Requirements: Class 1 Fire-Retardant per ASTM E 84.
3. Manufacturers and Products:

a. Convenience Products; Touch ˜˜N Foam, Easy Fill Latex Foam Sealant.
b. DAP Products, Inc.; DAPtex Plus.

E. Acoustical Sealants: As specified in Division 09 Section "Gypsum Board Assemblies".

F. Fire Resistive Sealants: As specified in Division 07 Section "Fire Resistive Joint Firestopping".

2.6 HIGH TEMPERATURE SILICONE SEALANT

A. Exterior/Interior High-Temperature Silicone Sealant:

1. One-component non-slumping silicone sealant for sealing and bonding applications exposed to temperatures as high as 600 deg F (315 deg C).
2. Manufacturer and Product: Dow; DOWSIL 736 Heat Resistant Sealant.

2.7 IMMERSIBLE ELASTOMERIC SEALANTS

A. Immersible Non-sag Urethane Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25 or 35; rated for immersion when tested according to ASTM C 1247.
2. Description: Single component polyurethane sealant, moisture curing, non-sag, non-staining as determined by pre-construction stain testing if exposed, suitable for immersion.

3. Joint Movement Capability: Plus 25 percent, minus 25 percent, or plus 35 percent, minus 35 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:
   a. Sika Corp.; Sikaflex NP 1.
   b. Sika Corp., Construction Products Div.; Sikaflex 1a.
   c. Tremco Commercial Sealants & Waterproofing; Vulkem 116 or Dymonic 100.
6. Color: As scheduled or as indicated in Design Selections.

B. Immersible Pourable Urethane Sealant:
1. Product Quality Standard: ASTM C 920, Type S, Grade P, Class 25.
   a. Rated for immersion when tested according to ASTM C 1247.
2. Description: Single component polyurethane sealant, moisture curing, pourable, suitable for immersion.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:
   a. Sika Corp., Construction Products Div.; Sikaflex 1c SL.
   b. Tremco Commercial Sealants & Waterproofing; Vulkem 45SSL.

2.8 JOINT SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
1. Use closed cell (Type C) sealant backing rod at formed sealant joints for typical conditions unless otherwise recommended by sealant manufacturer.
2. Use open cell (Type O) sealant backing rod at interior line of sealant for double sealed condition unless otherwise recommended by sealant manufacturer.

B. Cylindrical Sealant Backings:
1. Product Quality Standard: ASTM C 1330, Type C, Type O, Type B; as approved in writing by joint-sealant manufacturer for joint application indicated.
2. Description: Extruded polyethylene, polyurethane, or polyolefin in either closed cell structure (Type C), open cell structure (Type O), or bicellular structure with surface skin (Type B) as defined by ASTM Terminology C 717.
3. Size: Diameter approximately 25 percent larger than joint width, unless otherwise directed by manufacturer.
4. Manufacturers and Products:
   a. Type C:
      1) Sika Corp.; MasterSeal 920.
      2) Nomaco Inc.; Green Rod or HBR.
   b. Type O:
      1) Backer Rod Mfg. Inc.; Denver Foam.
      2) Nomaco Inc.; Foam-Pak II.
   c. Type B:
      1) Sika Corp.; MasterSeal 921.

2) Nomaco Inc.; Dual-Rod or Sof-Rod.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials, or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.9 PREFORMED SILICONE SHEETS AND TRANSITIONS

A. Preformed Cured Silicone Sheet and Transition Strips: Preformed silicone strip and molded pieces designed for flashing and transition applications, including closures between building envelope systems and spanning joints with large and/or dynamic movement.

1. Manufacturers and Products:

a. Dow; DOWSIL Silicone Transition System.
b. Momentive Performance Materials, Inc. / GE Silicones; UltraSpan.
c. Pecora; Sil-Span.
d. Sika Corp.; Sika Silbridge 400 Transition Sheet.
e. Tremco Commercial Sealants and Waterproofing; Proglaze Engineered Transition Assembly.

2.10 ACCESSORIES

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Non-porous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent non-porous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

D. Weep Hole Baffles: PVC-coated, reticulated open cell polyurethane foam, 30 - 40ppi sized for installation at 30 to 50 percent compression.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrate surfaces to receive products and systems and associated Work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Cleaning of Joints: Clean out joints immediately before installing joint backings and sealants to comply with joint sealant manufacturer's written instructions and following requirements:

1. Remove foreign material that could interfere with adhesion of joint sealant, including, but not limited to, dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean non-porous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
5. Substrate material allowed by sealant's ASTM C 920 Use Classification.

C. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer, or as required by pre-construction compatibility and adhesion testing. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

D. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.4 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Joint Sealant Backings: Install type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear backings.
3. Remove absorbent sealant backings that have become wet or damaged before sealant application and replace with dry materials.
4. Install closed cell backer rod at exterior joints unless indicated otherwise on Drawings.

   a. Use open cell backer rod at interior line of sealant for double sealed conditions.

5. Install bond-breaker tape behind sealants where backings are not used between sealants and backs of joints.

D. Joint Sealants: Install at same time as backings using proven techniques that comply with following:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
4. Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

   a. Remove excess sealant from surfaces adjacent to joints.
   b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   c. Use masking tape to protect surfaces adjacent to recessed tooled joints.

5. Install joint sealants in accordance with ASTM C 1193 as applicable to materials, applications, conditions indicated, and with the following profile configurations:

   a. Fillet: Figure 5.
   b. Bridge: Figure 6.
   c. Butt: Figure 8A (concave tooling), generally hour-glass shape with 2:1 width-to-depth ratio.

E. Sprayed Foam Insulating Gap Filler: Apply sprayed foam insulating gap filler within exterior wall assemblies using professional hand-held dispensing gun in accordance with manufacturer's written instructions.

1. Prior to installation of wall finish systems, apply sprayed foam insulating gap filler to gaps, cracks, cavities, openings, and voids in exterior wall back-up, including annular space around piping, ducts, conduits, wiring, and electrical outlets to seal off potential air drafts.
2. After sprayed foam sealant is applied, make flush with face of adjacent wall by using method recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

D. Contractor Field Adhesion Testing: Field test urethane and silicone sealant adhesion to joint substrates as follows:

1. General Requirements: Before installation, field test urethane and silicone sealant adhesion to joint substrates as follows

a. Locate test joints where indicated or, if not indicated, as directed by Architect.
b. Conduct field tests for each kind of urethane and silicone sealants and joint substrates indicated.
c. Notify Architect 7 days in advance of dates and times when test joints will be erected.

2. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform ten tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.

3. Test Methods: Joint sealant manufacturer's technical representative shall conduct following tests:

a. When Joint Substrates are Identical: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521:

1) Install 24 in (600 mm) long test specimens using same materials, methods for joint preparation, and joint sealant installation required for Work. Allow sealants to cure fully before testing.
2) Make horizontal knife cut across width of sealant joint from one substrate to other substrate.
3) Make 2 vertical cuts at both sides of substrates, downward starting at horizontal cut, approximately 3 in (75 mm) long.
4) Grasp 3 in (75 mm) long piece of sealant tab firmly 1 in (25 mm) from its bonded edge and pull at not less than 90 degree angle.
5) Substrate adhesion is acceptable if sealant tears cohesively within itself or elongates to a manufacturer determined extension value from 1 in (25 mm) gauge length before releasing from substrate adhesively.

b. When Joint Substrates are Different: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521:

1) Install 24 in (600 mm) long test specimens using same materials, methods for joint preparation, and joint sealant installation required for Work. Allow sealants to cure fully before testing.
2) Make first horizontal knife cut across width of sealant joint from one substrate to other substrate.

3) Make one vertical cut along one side of substrate, downward starting at horizontal cut, approximately 3 in (75 mm) long.
4) Make second horizontal knife cut across width of sealant joint from one substrate to other substrate at opposite end of 3 in (75 mm) long first cut.
5) Grasp 3 in (75 mm) long piece of sealant flap firmly and pull at not less than 90 degree angle.
6) Substrate adhesion is acceptable if sealant tears cohesively within itself or elongates to a manufacturer determined extension value from 1 in (25 mm) gauge length before releasing from substrate adhesively.

4. Reports: Inspect tested joints and report on the following:

a. Whether sealants filled joint cavities and are free of voids.
b. Whether sealant dimensions and configurations comply with specified requirements.
c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

3.6 CLEANING

A. Remove excess sealant or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.7 PROTECTION

A. Protect during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original Work.

3.8 JOINT SEALANT SCHEDULE

A. Exterior Elastomeric Sealant Applications:

1. Exterior Pourable Urethane Sealant:

a. Moving joints in exterior concrete walks and drives.

2. Exterior Non-sag Silicone Sealant:

a. Moving joints on exterior side of exterior walls.
b. Gaps between building materials and components created by items penetrating the primary drainage surface of the exterior building envelope.
c. Joints between dissimilar materials on exterior side of exterior walls.

3. Exterior Air and Water Barrier Sealant:

a. Exterior moving and non-moving joints sealed to weather barrier materials.

4. Exterior Non-Sag Urethane Sealant:

   a. Moving joints at precast concrete seating bowl:

B. Interior Elastomeric Sealant Applications:

1. Interior Non-sag Silicone Sealant:

   a. Non-moving joints in moist or damp areas which are susceptible to mildew.
   b. Non-moving joints in toilet rooms.
   c. Non-moving joints in kitchens.
   d. Non-moving joints in repeated contact with food.

2. Interior Non-sag Urethane Sealant:

   a. Building joints on interior side of exterior walls where joint movement is anticipated.

3. Interior Non-sag Acrylic Latex Sealant:

   a. Non-moving joints where another type of sealant is not otherwise specified or scheduled.
   b. Minimal moving joints due to temperature change.

C. Sprayed Foam Insulating Gap Filler Applications:

1. Exterior non-moving gaps around windows, glazed aluminum walls, doors, and penetrations beneath weather-resistant coverings.
2. Interior non-moving gaps around windows, glazed aluminum walls, doors, and penetrations.

D. Exterior/Interior High-Temperature Silicone Sealant:

1. High-temperature exterior or interior locations.

E. Immersible Elastomeric Sealant Applications:

1. Immersible Non-sag Urethane Sealant:

   a. Vertical moving and non-moving joints in fountains.

2. Immersible Pourable Urethane Sealant:

   a. Horizontal moving and non-moving joints in fountains.

3.9 COLOR SCHEDULE

A. Joint Sealant Colors:

1. Exterior Pourable Urethane Sealant:

   a. Color Selection:
   b. Color Selection: As selected from Manufacturer's Standard Colors.

2. Exterior Non-Sag Silicone Sealant:

   a. Color Selection:
   b. Color Selection: As selected from Manufacturer's Custom Colors.
   c. Color Selection: As selected from Manufacturer's Standard Colors.

3. Exterior Non-Sag Urethane Sealant for Precast Concrete Seating Bowl:

   a. Color Selection:
   b. Color Selection: As selected from Manufacturer's Custom Colors.
   c. Color Selection: As selected from Manufacturer's Standard Colors.

4. Interior Non-Sag Silicone Sealant:

    a. Color Selection: White.
    b. Color Selection: Transparent.
    c. Color Selection: As selected from Manufacturer's Standard Colors.

5. Interior Non-Sag Urethane Sealant:

    a. Color Selection:
    b. Color Selection: Special Custom Color as selected.
    c. Color Selection: As selected from Manufacturer's Custom Colors.
    d. Color Selection: As selected from Manufacturer's Standard Colors.

6. Interior Non-Sag Acrylic Latex Sealant:

    a. Color Selection:
    b. Color Selection: As selected from Manufacturer's Custom Colors.
    c. Color Selection: As selected from Manufacturer's Standard Colors.

7. Immersible Non-Sag Urethane Sealant:

    a. Color Selection:
    b. Color Selection: As selected from Manufacturer's Standard Colors.

8. Immersible Pourable Urethane Sealant:

    a. Color Selection:
    b. Color Selection: As selected from Manufacturer's Standard Colors.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Custom hollow metal doors and frames and supplementary items necessary for installation:

1. Interior custom hollow-metal doors and frames.
2. Exterior custom hollow-metal doors and frames.

B. Related Requirements:

1. Division 08 Section Door Hardware for door hardware for hollow-metal doors.
2. Section 119812 "Detention Doors and Frames" for hollow-metal doors and frames for detention facilities.
3. Division 13 Section Radiation Protection for lead-lined, hollow-metal doors and frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803.

B. Exterior: Areas exposed to the elements and areas located in unconditioned spaces.

C. Interior: Areas located in conditioned spaces.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Door core materials and construction.
3. Factory priming or finishing specifications.
4. Indicate scheduled fire doors that cannot qualify for labeling because of design, size, hardware or other reason.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Elevations of each door type.
3. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
5. Locations of reinforcement and preparations for hardware.
6. Details of each different wall opening condition.
7. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
8. Details of anchorages, joints, field splices, and connections.
9. Details of accessories.
10. Details of moldings, removable stops, and glazing.
11. Clearances.

C. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).
2. Fabrication: Prepare Samples approximately 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:
    a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
    b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Oversize Construction Certification: Documentation for assemblies required to be fire rated and exceeding limitations of labeled assemblies.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

C. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

C. Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80 and NFPA 101.

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.9 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

C. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

D. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

E. Windborne-Debris-Impact-Resistance Performance: Comply with impact resistance testing requirements for Wind Zone.

F. Thermally Rated Exterior Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. (2.27 W/K x sq. m) when tested in accordance with ASTM C1363 or ASTM E1423.

G. Exterior Door Air Infiltration: Maximum air leakage of 0.20 cfm/sf (0.09 L/s per sq m) when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sf (75 Pa).

2.3 INTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

A. Interior Commercial Doors and Frames: NAAMM-HMMA 861; ANSI/SDI A250.4, Physical Performance Level A.

1. Locations:

a. Interior doors and frames.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
d. Door Edge Construction: Seamless, continuously welded with no visible seam.

1) End Channels: Close top and bottom edges with continuous flush channels, minimum thickness of 0.053 inch (1.3 mm), fabricated from same material as face sheets and spot welded to face sheets.

e. Core Construction: Steel stiffened.

1) Welded Vertical Steel Stiffeners: Manufacturer's standard vertical steel stiffener extending full-door height, spot welded to face sheets. Fill spaces between stiffeners with mineral-fiber insulation.

f. Fire-Rated Core Construction: Manufacturer's standard vertical steel stiffener core for fire-rated doors.

3. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm), except 0.067 inch (1.7 mm) for openings exceeding 4 feet (1219 mm) wide.
b. Sidelite and Transom Frames: Fabricated from same material as adjacent door frame.
c. Construction: Close contact edges of corner joints tight with mitered faces; full profile, continuously welded.

1) Knocked down frame construction not permitted.

4. Exposed Finish: Prime.

2.4 EXTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

A. Exterior Commercial Doors and Frames: NAAMM-HMMA 861; ANSI/SDI A250.4, Physical Performance Level A.

1. Locations:

a. Exterior doors and frames.
b. All doors and frames in parking garages.
c. All doors and frames in central energy plants.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.30 mm), with minimum G60 or A60 (ZF180) coating.
d. Door Edge Construction: Seamless, continuously welded with no visible seam.

1) End Channels: Close top and bottom edges with continuous flush channels, minimum thickness of 0.053 inch (1.3 mm), fabricated from same material as face sheets and spot welded to face sheets.

e. Top Edge Closures: Seal joints against water penetration.
f. Bottom Edge Closures: Provide weep hole openings in bottoms of exterior doors to permit moisture to escape.
g. Core Construction: Steel stiffened.

1) Welded Vertical Steel Stiffeners: Manufacturer's standard vertical steel stiffener extending full-door height, spot welded to face sheets. Fill spaces between stiffeners with mineral-fiber insulation.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum G60 or A60 (ZF180) coating.
b. Construction: Close contact edges of corner joints tight with mitered faces; full profile, continuously welded.

1) Knocked down frame construction not permitted.

4. Exposed Finish: Prime.

2.5 BORROWED LITES

A. Borrowed Lite Frames: Fabricate from same materials, construction, and finish as door frame assemblies.

B. Construction: Close contact edges of corner joints tight with mitered faces; full profile, continuously welded.

1. Knocked down frame construction not permitted.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.7 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.

a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 in (1.10 mm) thick.
b. Masonry Type: Adjustable Z-clip type or T-shaped anchors to suit frame size, not less than 0.042 in (1.10 mm) thick, with corrugated or perforated straps not less than 2 in (50 mm) wide by 10 in (250 mm) long.

2. Quantity and Location:

a. Stud-Wall Type: Locate anchors not more than 18 in (450 mm) from top and bottom of frame. Space anchors not more than 32 in (800 mm) on centers and as follows:

1) Three anchors per jamb up to 60 in (1500 mm) high.
2) Four anchors per jamb from 60 to 90 in (1500 to 2250 mm) high.
3) Five anchors per jamb from 90 to 96 in (2250 to 2400 mm) high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 in (600 mm) or fraction thereof above 96 in (2400 mm) high.
5) Two anchors per head for frames above 42 in (1050 mm) wide and mounted in metal-stud partitions.

b. Masonry Type: Locate anchors not more than 18 in (450 mm) from top and bottom of frame. Space anchors not more than 32 in (800 mm) on centers and as follows:

1) Two anchors per jamb up to 60 in (1500 mm) high.
2) Three anchors per jamb from 60 to 90 in (1500 to 2250 mm) high.
3) Four anchors per jamb from 90 to 120 in (2250 to 3000 mm) high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 in (600 mm) or fraction thereof above 120 in (3000 mm) high.

3. Postinstalled Expansion Anchor for In-Place Concrete or Masonry: Countersunk, flat or oval head exposed screws and bolts, Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor; fabricated from same material as frames and welded to bottom of jambs and mullions, minimum thickness 0.0428 in (1.10 mm), terminate bottom of frames at top of finish floor.

1. Monolithic Concrete Slabs: Clip type anchors, with two holes to receive fasteners.

C. Floor Anchors for Concrete Slabs with Underlayment/Topping: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls and other exterior locations, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.8 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating. Thickness indicated is for uncoated steel.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

1. Available Manufacturers:

a. Construction Materials, Inc.
b. Heckman Building Products, Inc.
c. Hilti Corp.
d. ITW Ramset/Red Head.
e. Powers Fasteners.
f. Simpson Strong Tie Anchor Systems.

2. Post-Tensioned Concrete: For post-tensioned concrete, fasteners shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed fasteners in post-tensioned concrete prior to installation.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Division 08 Section Glazing.

H. Grout for Frames: ASTM C 476, except with maximum slump of 4 in (100 mm) according to ASTM C 143 / C 143M.

I. Bituminous Frame Back Coating for Grouted Frames: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.9 FABRICATION

A. General Requirements: Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Factory fit and assemble units in manufacturer's plant.

1. Manufacturing Standards: ANSI/NAAMM-HMMA 861.

B. Hollow-Metal Doors: Fabricate doors not less than 1-3/4 in (44 mm) thick, seamless hollow metal construction unless otherwise indicated. Construct doors with smooth surfaces and without visible joints or seams on exposed faces.

C. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

D. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

Normally delete terminated (hospital stops) unless requested by the Owner. Confirm with Team.

4. Terminated Stops (Hospital Stops): Terminate stops 6 inches (152 mm) above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

E. Guards for Grouted Frame Installations: At back of hardware cutouts, install 0.016 in (0.4 mm) (26 gage) thick grout guards or dust-cover boxes of same material as frame, welded to frame to close off interior of openings and prevent grout or other materials from obstructing hardware operation.

F. Head Reinforcement for Grouted Frame Installations: Provide minimum 0.093 in (2.3 mm) (12 gage) thick, steel channel or angle stiffener for opening widths more than 48 in (1200 mm).

G. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware. Minimum Reinforcing Thickness for Door Hardware:

a. Hinges and Pivots: 0.167 in (4.2 mm) thickness by 1-1/2 in wide by 6 in (38 mm by 150 mm) longer than hinge.
b. Locks, Strikes, Flush Bolts and Closers: 0.093 in (2.3 mm) thickness.
c. Surface Mounted Hold Open Arms and Panic Devices: 0.093 in (2.3 mm) thickness.
d. Other Surface Applied Hardware: 0.067 in (1.7 mm) thickness.

2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
3. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections

H. Glazed Lites: Provide continuous frame for glazed openings between face sheets; miter corners, weld frame to face sheets, and grind smooth. Provide stops and moldings around glazed lites. Form corners of stops and moldings with butted or mitered hairline joints.

1. Provide stops and moldings around glazed lites, flush with face of door, and with square stops unless otherwise indicated.
   a. Use same materials as door face sheet for frame and loose stop for flush glazing
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed formed frame on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
   a. Do not overlap frame molding on face of door.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.10 STEEL FINISHES

A. Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products for recommendations for cleaning, treating, priming, and when specified, finishing.

B. Uncoated Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, Solvent Cleaning; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 3, Power Tool Cleaning, or SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.

C. Metallic-Coated Steel Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with primer. Clean welds, mechanical connections, abraded areas and apply galvanizing repair paint.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds and other surfaces; comply with SSPC-Paint 20.

D. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

E. Bituminous Frame Back Coating: Apply manufacturer recommended bituminous back coating when frames are grout filled.

F. Field Applied Coatings: Comply with Division 09 Section Painting for substrate preparation and painting requirements.

2.11 LOUVERS

A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
   1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
   2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

B. Fabricate louvers and mount flush into doors without overlapping moldings on surface of door face sheets. Provide internal support recommended by manufacturer. Provide louvers with minimum of 50% free air area unless indicated otherwise.

C. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

C. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.4 INSTALLATION

A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with NAAMM-HMMA 840.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

   a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
   b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with post-installed expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

4. Sound Rated Partitions: Solidly pack mineral-fiber insulation inside frames.
5. Exterior Walls: Solidly fill space between frames wall construction with mineral-fiber insulation unless indicated otherwise.
6. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

a. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

7. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Contractor Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

a. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

C. Contractor Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101.

3.6 ADJUSTMENTS AND REPAIRS

A. Final Adjustments: Remove and replace defective hollow metal work, including work that is warped, bowed, or otherwise unacceptable.

B. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

1. Inspect hollow metal frames located in wet areas and bathrooms; prepare and reprime damaged areas to prevent rusting and bleed through.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 081216
INTERIOR ALUMINUM FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior aluminum frames for doors and glazing installed in gypsum board partitions and supplementary items necessary for installation.

B. Related Section:

1. Division 08 Section "Interior Storefront" for interior aluminum storefront installations.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include construction details, material descriptions, dimensions of individual components and profiles, fire-resistance rating, and finishes.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include the following:

1. Include elevations, sections, and installation details for each wall-opening condition.
2. Include details for each frame type, including dimensioned profiles and metal thicknesses.
3. Include locations of reinforcements and preparations for hardware.
4. Include details of anchorages, joints, field splices, connections, and accessories.
5. Include details of moldings, removable stops, and glazing.
6. Include details of conduits and preparations for power, signal, and control systems.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Framing Member and Finish: 12 inches (300 mm) long. Include trim.
2. Corner Fabrication: 12 by 12 in (300 by 300 mm) long, full-size window corner, including full-size sections of extrusions with factory-applied color finish.

D. Product Schedule: For aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum frames to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic. Store frames under cover at Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Dual Lock Partition Systems, Inc.; Avalon International Aluminum.
2. Frameworks Manufacturing Inc.; a Div. of ASSA ABLOY.
3. Fry Reglet Architectural Systems.
4. RACO Interior Products, Inc.
5. Western Integrated Materials, Inc.
6. Wilson Partitions.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Fire-Rated Frames: Frames for fire-rated door assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Frames for Smoke- and Draft-Control Assemblies: Tested according to UL 1784 and installed in compliance with NFPA 105.

a. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (0.9 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa).

2.4 INTERIOR ALUMINUM DOOR FRAMES AND GLAZING FRAMES

A. Aluminum Framing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or alloy and temper required to suit structural and finish requirements, not less than 0.062 in (1.6 mm) thick.

B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.

1. Fire-Protection Rating: Fabricate aluminum frame assemblies to provide fire protection rating as scheduled.

C. Glazing Frames: Extruded aluminum, for glazing thickness indicated.

D. Ceiling Tracks: Extruded aluminum.

E. Trim: Extruded aluminum, not less than 0.062 in (1.6 mm) thick, with removable snap-in casing trim, glazing stops, and door stops without exposed fasteners.

F. Frame and Trim Finish:

1. Color: As scheduled or indicated in Design Selections.

2.5 INTERIOR TRIMLESS ALUMINUM DOOR FRAMES

A. Trimless Door Frames: Extruded aluminum frame, factory mitered to install with hair-line seams and integral drywall finish flanges designed to provide minimized door frame exposure.

1. Basis of Design: EZConcept; EzyJamb SRC or ISD Flush Door Frame Profiles with Concealed Hinges, configuration as indicated on Drawings.

a. Fire-Protection Rating: Fabricate aluminum frame assemblies to provide fire protection rating as scheduled.

B. Hardware: Hinge jamb shall be factory assembled with concealed hinges.

C. Frame and Trim Finish:

1. Color: As scheduled or indicated in Design Selections.

2.6 ACCESSORIES

A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.

B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals.

C. Smoke Seals for Fire-Rated Installations: Intumescent strip or fire-rated gaskets.

1. Color: As selected by Architect from manufacturer standard colors.

D. Glazing Gaskets: Manufacturer's standard extruded or molded plastic, to accommodate glazing thickness indicated.

E. Glass and Glazing: Comply with requirements in Division 08 Section Glazing.

F. Door Hardware: Comply with requirements in Division 08 Section Door Hardware.

2.7 FABRICATION

A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted or mitered connections.

B. Factory prepare interior aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as required by fire-rated label for assembly.

C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.

1. Locate removable stops on the inside of spaces accessed by keyed doors.

D. Fabricate components to allow secure installation without exposed fasteners.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish Selections: As scheduled or indicated in Design Selections.

2.9 ALUMINUM FINISHES

A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

C. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

D. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

E. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2604 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Verify that wall thickness does not exceed standard tolerances allowed by throat size indicated.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place; according to manufacturer's written instructions.

1. Fire-Rated and Smoke-Control Assemblies: At fire-protection-rated openings, install interior aluminum frames according to NFPA 80 and NFPA 105.

B. Install frame components in the longest possible lengths; components up to 96 in (2400 mm) long must be one piece.

1. Frames Supported by Suspended Ceiling: Fasten to suspended ceiling grid on maximum 48 in (1220 mm) centers, using sheet metal screws or other fasteners approved by frame manufacturer.
2. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
3. Secure clips to extruded main-frame components and not to snap-in or trim members.
4. Do not leave screws or other fasteners exposed to view when installation is complete.

C. Glass: Install glass according to Division 8 Section Glazing and aluminum-frame manufacturer's written instructions.

D. Doors: Install doors aligned with frames and fitted with required hardware.

E. Door Hardware: Install according to Division 8 Section Door Hardware and aluminum-frame manufacturer's written instructions.

3.5 ADJUSTING

A. Inspect installation, correct misalignments, and tighten loose connections.

B. Doors: Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly, and lubricate as recommended by manufacturer.

C. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended by frame manufacturer and according to AAMA 609 & 610.

D. Touch up marred frame surfaces so touchup is not visible from a distance of 48 in (1200 mm). Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

3.6 FINISH SCHEDULE

A. Color Anodic Finish:

1. Color: Light bronze.
2. Color: Medium bronze.
3. Color: Dark bronze.
4. Color: Black.
5. Color: Match Architect's sample.
6. Color: As selected by Architect from full range of industry colors and color densities.

B. Baked-Enamel or Powder-Coat Finish:

1. Color and Gloss: Match Architect's sample.
2. Color and Gloss: As selected by Architect from manufacturer's full range.
3. Color and Gloss: <Insert>

C. Fluoropolymer Finish:

1. Color and Gloss: Match Architect's sample.
2. Color and Gloss: <Insert>

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 081416
SOLID CORE FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Solid core flush wood doors, finishing and supplementary items necessary for installation.

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Five-ply flush wood doors for opaque finish.
3. Solid-core flush wood doors with plastic-laminate-faces.
4. Solid-core impact resistant panel faced doors.
5. Wood door frames.
6. Factory priming flush wood doors.
7. Factory finishing flush wood doors.
8. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Division 06 Section Interior Architectural Woodwork for requirements for veneers from the same flitches for both flush wood doors and wood paneling.
2. Division 08 Section Glazing for glass panels in flush wood doors.
3. Division 09 Section Painting for field finishing doors.
4. Division 13 Section Radiation Protection for lead-lined flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Door core materials and construction.
3. Door edge construction, light frames, and trim for openings.
4. Door face type and characteristics.
5. Door louvers.
6. Door trim for openings.
7. Door frame construction.
8. Factory-machining criteria.
9. Factory priming or finishing specifications.
10. Indicate scheduled fire doors that cannot qualify for labeling because of design, size, hardware or other reason.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.

6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory primed or finished and application requirements.

C. Samples for Verification:

1. Transparent and Opaque Finish Doors: Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Plastic Laminate Doors: Plastic laminate, 6 inches (150 mm) square, for each color, texture, and pattern selected.
3. Impact Resistant Panel Doors: Impact resistant panel door facing, 6 in (150 mm) square, for each color, texture, and pattern selected.
4. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
5. Door Louvers: Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
6. Light Frames: Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

C. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.

B. Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80 and NFPA 101.

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in opaque plastic bags or cardboard cartons.

C. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration.

D. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4-inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors and frames.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Marshfield Door Systems, Inc.
4. Mohawk Flush Doors, Inc.; a Masonite Company.
5. Oshkosh Architectural Door Company.

6. VT Industries Inc.
7. Construction Specialties, Inc. (C/S Group)

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Obtain flush wood doors and wood paneling from single manufacturer when doors are indicated to blueprint match paneling.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.4 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Use only materials that comply with referenced standards and other requirements specified.

B. Quality Standard: In addition to requirements specified, comply with AWI "Architectural Woodwork Standards."

1. Provide labels and certificates from AWI certification program indicating that doors and frames comply with requirements of grades specified.

a. Contractor shall register the Work under this Section with the AWI Quality Certification Program.

2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.
3. Performance Grade by Location:

a. ANSI/WDMA I.S. 1A Heavy Duty: Typical locations, unless indicated otherwise below.
b. ANSI/WDMA I.S. 1A Extra Heavy Duty: Locations include classrooms, public toilets, janitor's closets, assembly spaces, exits, patient rooms, and where indicated on Drawings.

C. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

D. Solid Core Doors, General:

1. Edge Construction:

a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

1) At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

a) Screw-Holding Capability: Extra Heavy Duty, 550 lbf (2440 N); Heavy Duty, 475 lbf (2110 N) in accordance with WDMA T.M. 10.

b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

1) At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

a) Screw-Holding Capability: Extra Heavy Duty, 550 lbf (2440 N); Heavy Duty, 475 lbf (2110 N) in accordance with WDMA T.M. 10.

c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: Extra Heavy Duty, 550 lbf (2440 N); Heavy Duty, 475 lbf (2110 N) in accordance with WDMA T.M. 10.

2. Core for Non-Fire-Rated Doors:

a. ANSI A208.1, Grade LD-2 particleboard.

1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware and as follows:

a) 5-inch (125-mm) top-rail blocking.
b) 5-inch (125-mm) bottom-rail blocking.
c) 5-by-10-inch (125 mm by 250 mm) lock blocks.

2) Provide doors with WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices.

b. WDMA I.S. 10 structural composite lumber.

1) Screw Withdrawal, Door Face: Extra Heavy Duty, 550 lbf (2440 N); Heavy Duty, 475 lbf (2110 N).
2) Screw Withdrawal, Vertical Door Edge: Extra Heavy Duty, 550 lbf (2440 N); Heavy Duty, 475 lbf (2110 N).

3. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware and as follows:

1) 5-inch (125-mm) top-rail blocking.
2) 5-inch (125-mm) bottom-rail blocking.
3) 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
4) 5-by-10-inch (125-by-250-mm) lock blocks or 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
5) 5-by-10-inch (125 mm by 250 mm) lock blocks.

4. Solid Core Door Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 SOLID-CORE FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Architectural Woodwork Standards Grade: Premium, with Grade AA wood veneer faces.
2. Faces: Single plywood veneer not less than 1/50 inch (0.508 mm) thick.
3. Species and Cut: As scheduled or indicated in Design Selections.

a. Match between Veneer Leaves: Book or Slip match as indicated
b. Assembly of Veneer Leaves on Door Faces: Center-balance or Balance match as indicated
c. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
d. Room Match:

1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet (6 m) or more.

e. Transom Match: Continuous match.
f. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in "Interior Architectural Woodwork."

4. Vertical Edges: Applied wood-veneer edges of same species as faces and covering edges of faces; sanded eased edges.
5. Horizontal Edges: Unfaced, sanded smooth, with factory applied seal coat.

a. Top Edges Exposed to View: Match exposed vertical edges.

2.6 SOLID-CORE FLUSH WOOD DOORS FOR OPAQUE FINISH

A. Interior Doors, Solid-Core Five-Ply:

1. Architectural Woodwork Standards Grade: Premium.
2. Faces: MDO.

a. Apply MDO to standard-thickness, closed-grain, hardwood face veneers.

3. Finish Selection: As scheduled or indicated in Design Selections.
4. Vertical Edges: Any closed-grain hardwood; sanded eased edges.
5. Horizontal Edges: Unfaced, sanded smooth, with factory applied seal coat.

a. Top Edges Exposed to View: Match exposed vertical edges.

2.7 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

A. Interior Doors, Solid Core:

1. Architectural Woodwork Standards Grade: Premium.

2. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
   a. Description: High-pressure decorative laminates, 0.048 in (1.2 mm) minimum thickness.
3. Finish Selection: As scheduled or indicated in Design Selections.
4. Vertical Edges: Plastic laminate that matches faces, applied before faces.
5. Horizontal Edges: Unfaced, sanded smooth, with factory applied seal coat.
   a. Top Edges Exposed to View: Match exposed vertical edges.

2.8 SOLID-CORE FLUSH WOOD DOORS, IMPACT RESISTANT

A. Interior Doors, Solid Core:
1. Architectural Woodwork Standards Grade: Premium.
2. Performance Grade: ANSI/WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
3. Impact Resistant Panel Door Faces: Manufacturer's standard impact resistant panel, 0.040 in (1.0 mm) minimum thickness.
4. Impact Resistant Panel Selection: As scheduled or as indicated in Design Selection.
5. Vertical Edges:
   a. Matching Color Door Stile: Provide one of the following:
      1) Impact resistant panel edging that matches faces, applied before faces.
      2) Manufacturer's standard replaceable secondary door stile with 0.060 in (1.5 mm) thick impact resistant panel edging that matches faces.
   b. Alternate Color Door Stile: Manufacturer's standard replaceable secondary door stile with 0.060 in (1.5 mm) thick vinyl impact resistant panel edging as selected by Architect.
   c. Stainless Steel Door Stile: Manufacturer's standard replaceable secondary door stile with 20 gage Type 304 stainless steel edging with No. 4 finish.

2.9 WOOD DOOR FRAMES

A. Interior Frames:
1. Architectural Woodwork Standards Grade: Match grade indicated for doors.
2. Wood Species and Cut: Match species and cut indicated for wood doors unless otherwise indicated.
3. Wood Moisture Content: As recommended by Architectural Woodwork Standards.
4. Profile: Single rabbet unless indicated otherwise on Drawings.

B. Construction: Solid lumber, particleboard, or medium density fiberboard (MDF) with veneered exposed surfaces.

2.10 FIRE-RATED WOOD DOOR FRAMES

A. Interior Frames:
1. Architectural Woodwork Standards Grade: Match grade indicated for doors.
2. Wood Species and Cut: Match species and cut indicated for wood doors unless otherwise indicated.
3. Wood Moisture Content: As recommended by Architectural Woodwork Standards.
4. Profile: Single rabbet unless indicated otherwise on Drawings.

B. Construction: Solid lumber, fire-retardant particleboard, or fire-retardant medium density fiberboard (MDF) with veneered exposed surfaces and listed and labeled by a testing and

inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated on Drawings.

2.11 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species and finish as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
4. Glass: Comply with Division 08 Glazing.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

1. Glass: Comply with Division 08 Glazing.

C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; and approved for use in doors of fire-protection rating indicated on Drawings.

1. Finish: Baked-enamel- or powder-coated finish.

a. Color Selection: As scheduled or as indicated in Design Selections.

2. Glass: Comply with Division 08 Glazing.

D. Integral Louver Blinds Unit: 1 in (25 mm) thick insulated glass unit consisting of two 1/8 in (3 mm) tempered glass lites sandwiched with white mini-blinds in air space; blinds to be tilted via external ADA-compliant device both sides of door (unless indicated otherwise) having a force to tilt blinds of less than 2.25 lbf (10 N). Provide integral louver blinds manufacturer's standard framing kit for a complete installation.

1. Manufacturer and Product: Kyler Industries; Screenline series, Model SL20AA (Tilt Only, Dual Operator).

E. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.

1. Wood Species: Same species and finish as door faces..
2. Profile: Chevron.

F. Metal Louvers:

1. Blade Type: Vision-proof, inverted V; set in continuous metal frame covering door cutout.
2. Metal and Finish:

a. Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick.

1) Finish: Baked-enamel- or powder-coated finish.

a) Color Selection: As scheduled or indicated in Design Selections.

b. Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.
c. Extruded aluminum with dark bronze, Class II, color anodic finish, AA-M12C22A32/A34.

G. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.

1. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick.

a. Finish: Baked-enamel- or powder-coated finish.

1) Color Selection: As scheduled or indicated in Design Selections.

2.12 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

a. Do not trim stiles and rails in excess of limits permitted for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Seal edges of doors, edges of cutouts, and mortises with sealer coat after fitting and machining.

D. Transom and Side Panels:

1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

E. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Glazing.
3. Louvers: Factory install louvers in prepared openings.

2.13 FACTORY PRIMING

A. Doors for Opaque Finish: Factory prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Division 09 Section Painting.

2.14 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on edges of cutouts, and mortises.

B. Factory finish doors, unless indicated otherwise.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Same grade for finish as specified for doors.
2. Architectural Woodwork Standards System-5, Varnish, Conversion.
3. Staining, Effect and Sheen: Match Architect's sample, as scheduled or indicated in Design Selections.

D. Opaque Finish:

1. Architectural Woodwork Standards Grade: Same grade for finish as specified for doors.
2. Architectural Woodwork Standards System-5, Varnish, Conversion.
3. Color and Sheen: Match Architect's sample, as scheduled or indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

3.2 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.3 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Hardware: For installation, see Division 8 Section Door Hardware.

C. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

D. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3.2 mm in 2400 mm).
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.
4. Install smoke- and draft-control doors in accordance with NFPA 105.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

1. Clearances:

a. Head, Jambs and Pairs of Doors: Provide 1/8-inch (3.2 mm) maximum at heads, jambs, and between pairs of doors.
b. Between Bottom of Door and Top of Threshold: Where threshold is shown or scheduled, provide 1/4-inch (6.4 mm) maximum from bottom of door to top of threshold unless otherwise indicated.
c. Between Bottom of Door and Top of Finished Floor Material - No Threshold: Provide 3/4-inch (19 mm) maximum from bottom of door to top of finished floor material unless otherwise indicated on Drawings.
d. Between Bottom of Door and Top of Finished Floor Material - No Threshold and Bottom of Door is more than 38 inches (965 mm) above the Finished Floor: Provide 3/8-inch (10 mm) maximum from bottom of door to top of finished floor material or comply with manufacturer’s door labeling procedure.

F. Factory-Finished Doors: Restore finish before installation when fitting or machining is required at Project site.

3.4 FIELD QUALITY CONTROL

A. Contractor Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

a. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

C. Contractor Inspections:

1. Provide inspection of installed Work through AWI's Quality Certification Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80.
3. Egress Door Inspections: When applicable, inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101.

3.5 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

3.6 FINISH SCHEDULE

A. Wood Veneer Faced Doors for Transparent Finish:

1. Species and Cut Selection: Match sample accepted by Architect.
2. Species and Cut Selection:
3. Finish: Match sample accepted by Architect.
4. Finish: As follows:

a. Grade: Premium.
b. Product Quality Standard Finish Designation:

1) AWI conversion varnish system.
2) WI System 4 clear conversion varnish system.

c. Staining: Match sample accepted by Architect.
d. Effect: Open-grain finish.
e. Effect: Filled finish.
f. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
g. Sheen: Satin.

B. Doors for Opaque Finish:

1. Finish: <Insert selection here> Match sample accepted by Architect.
2. Finish:
3. Finish: As follows:

a. Grade: Premium.
b. Product Quality Standard Finish Designation:

1) AWI conversion varnish.
2) WI System 4 clear conversion varnish.

c. Color: Match sample accepted by Architect.
d. Sheen: Semigloss.

C. Plastic Laminate Faced Doors:

1. Plastic Laminate Selection: Match sample accepted by Architect.
2. Plastic Laminate Selection: <Insert selection here>

D. Impact Resistant Panel Face Doors:

1. Impact Resistant Panel Selection: Match sample accepted by Architect. <Insert selection here>
2. Impact Resistant Panel Selection:

E. Light Frames

1. Color Selection: <Insert selection here>
2. Color Selection: Match sample accepted by Architect.

F. Metal Louver:

1. Color Selection:
2. Color Selection: Match sample accepted by Architect.

G. Metal Louver for Fire Rated Door

1. Color Selection:
2. Color Selection: Match sample accepted by Architect.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 081433
STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Stile and rail wood doors, finishing and supplementary items necessary for installation.

1. Stile and rail wood doors.
2. Wood door frames.
3. Factory priming stile and rail wood doors.
4. Factory finishing stile and rail wood doors.
5. Factory fitting stile and rail wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Division 06 Section Interior Architectural Woodwork for requirements for veneers from the same flitches for both wood paneling and stile and rail wood doors.
2. Division 08 Section Glazing for glass panels in flush wood doors.
3. Division 09 Section Painting for field finishing doors.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Details of construction and glazing.
3. Door frame construction.
4. Factory-machining criteria.
5. Factory priming and finishing specifications.
6. Indicate scheduled fire doors that cannot qualify for labeling because of design, size, hardware or other reason.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimensions and location of hardware, lite locations, and glazing thickness.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of mortises and holes for hardware.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Doors to be factory primed or finished and application requirements.

C. Samples for Verification:

1. Transparent and Opaque Finish Doors: Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish.

For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
3. Frames for light openings, 6 in (150 mm) long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

C. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS.

A. Maintenance Data: To include in maintenance manuals.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.

B. Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80, Section 5.2.3.1. and NFPA 101, Section 7.2.1.15.4.

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in opaque plastic bags or cardboard cartons.

C. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration.

D. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity levels designed for building occupants for the remainder of construction period.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors and frames.
3. Warranty Period for Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Maiman Company (The); a Masonite Company.
4. Marshfield Door Systems, Inc.
5. Oshkosh Architectural Door Company.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Obtain stile and rail wood doors and wood paneling from single manufacturer when doors are indicated to match paneling.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Fire-Rated Assemblies: Complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to UL 10C or NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.4 STILE AND RAIL WOOD DOORS AND FRAMES, GENERAL

A. Use only materials that comply with referenced standards and other requirements specified.

B. Quality Standard: In addition to requirements specified, comply with AWI "Architectural Woodwork Standards."

1. Provide labels and certificates from AWI certification program indicating that doors and frames comply with requirements of grades specified.

a. Contractor shall register the Work under this Section with the AWI Quality Certification Program.

2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.
3. Performance Grade by Location:

a. ANSI/WDMA I.S. 6A Heavy Duty: Typical locations, unless indicated otherwise below.
b. ANSI/WDMA I.S. 6A Extra Heavy Duty: Locations include classrooms, public toilets, janitor's closets, assembly spaces, exits, patient rooms, and where indicated on Drawings.

4. Assemble interior doors, including components, with either dry-use or wet-use adhesives complying with ASTM D5572 for finger joints and with ASTM D5751 for joints other than finger joints.

C. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

D. Stile and Rail Doors, General:

1. Edge Construction:

a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

1) At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

a) Screw-Holding Capability: Extra Heavy Duty, 550 lbf (2440 N); Heavy Duty, 475 lbf (2110 N) in accordance with WDMA T.M. 10.

b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

1) At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

a) Screw-Holding Capability: Extra Heavy Duty, 550 lbf (2440 N); Heavy Duty, 475 lbf (2110 N) in accordance with WDMA T.M. 10.

c. Horizontal Edges: Sanded smooth, with factory applied seal coat.

1) Top Edges Exposed to View: Match exposed vertical edges.

E. Panel Products: Any of the following unless otherwise indicated:

1. Particleboard: ANSI A208.1, Grade M-2.
2. Medium-density fiberboard (MDF), complying with ANSI A208.2, Grade 130.
3. Hardboard complying with ANSI A135.4.
4. Veneer-core plywood.

F. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

2.5 STILE AND RAIL WOOD DOORS

A. Interior Stile and Rail Wood Doors:

1. Architectural Woodwork Standards Grade: Premium.
2. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
3. Transparent Finish:

a. Species and Cut Selection: As scheduled or as indicated in Design Selections.

4. Door Construction for Transparent Finish:

a. Stile and Rail Construction:

1) Veneered, structural composite lumber or veneered, edge- and end-glued clear lumber. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. Use veneers not less than 1/16 inch (1.6 mm) thick.

b. Raised-Panel Construction:

1) Veneered, wood-based panel product with mitered, raised rims made from matching clear lumber.

c. Flat-Panel Construction: Veneered, wood-based panel product.

5. Opaque Finish:

a. Finish Selection: As scheduled or as indicated in Design Selections.

6. Door Construction for Opaque Finish:

a. Stile and Rail Construction:

1) Veneered, structural composite lumber or veneered edge- and end-glued lumber.

b. Raised-Panel Construction: Shaped, medium-density fiberboard.
c. Flat-Panel Construction: Veneered, wood-based panel product.

7. Stile and Rail Widths: As indicated, but not less than the following:]

a. Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm).
b. Bottom Rails: 10 in (255 mm).

8. Raised-Panel Thickness: As indicated, but not less than 1-1/8 inches (29 mm).
9. Flat-Panel Thickness: As indicated, but not less than 1/2 inch (13 mm.
10. Molding Profile (Sticking): As selected by Architect from manufacturer's full range.
11. Glass: Comply with Division 08 Section Glazing.

2.6 FIRE-RATED STILE AND RAIL WOOD DOORS

A. 20-Minute, Interior Fire-Rated Stile and Rail Wood Doors:

1. Architectural Woodwork Standards Grade: Premium.
2. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
3. Transparent Finish:

a. Species and Cut Selection: As scheduled or as indicated in Design Selections

4. Door Construction for Transparent Finish: 1-3/4-inch- (44-mm-) thick stiles and rails and veneered; flat panels not less than 5/8 inch (16 mm) thick; raised panels not less than 1-1/8 inches (29 mm) thick.

a. Stile and Rail Construction: Veneered, structural composite lumber or veneered, edge- and end-glued clear lumber. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. Use veneers not less than 1/16 inch (1.6 mm) thick.
b. Raised-Panel Construction: Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.
c. Flat-Panel Construction: Veneered, wood-based panel product.

5. Opaque Finish:

a. Finish Selection: As scheduled or as indicated in Design Selections.

6. Door Construction for Opaque Finish: 1-3/4-inch- (44-mm-) thick stiles and rails and veneered; flat panels not less than 5/8 inch (16 mm) thick; raised panels not less than 1-1/8 inches (29 mm) thick.

a. Stile and Rail Construction: Veneered, structural composite lumber or veneered edge- and end-glued lumber.
b. Raised-Panel Construction: Shaped medium-density fiberboard (MDF.)
c. Flat-Panel Construction: Veneered, wood-based panel product or Medium-density fiberboard (MDF).

7. Stile and Rail Widths: As indicated, but not less than the following:

a. Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm).
b. Bottom Rails: 10 in (255 mm).

8. Molding Profile (Sticking): As selected by Architect from manufacturer's full range.

B. 45-Minute, Interior Fire-Rated Stile and Rail Wood Doors:

1. Architectural Woodwork Standards Grade: Premium.
2. Panel Designs: Indicate on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
3. Transparent Finish:

   a. Species and Cut Selection: As scheduled or as indicated in Design Selections

4. Opaque Finish:

   a. Finish Selection: As scheduled or as indicated in Design Selections.

5. Interior Fire-Rated Door Construction: 1-3/4-inch- (44-mm-) thick, edged and veneered mineral-core stiles and rails and 1-1/8-inch- (29-mm-) thick, veneered mineral-core raised panels.
6. Stile and Rail Widths: As indicated, but not less than the following:

   a. Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm).
   b. Bottom Rails: 10 in (255 mm).

7. Molding Profile (Sticking): As selected by Architect from manufacturer's full range.

2.7 WOOD DOOR FRAMES

A. Interior Frames:

1. Architectural Woodwork Standards Grade: Match grade indicated for doors.
2. Wood Species and Cut: Match species and cut indicated for wood doors unless otherwise indicated.
3. Wood Moisture Content: As recommended by Architectural Woodwork Standards.
4. Profile: Single rabbet unless indicated otherwise on Drawings.

B. Construction: Solid lumber, particleboard, or medium density fiberboard (MDF) with veneered exposed surfaces.

2.8 FIRE-RATED WOOD DOOR FRAMES

A. Interior Frames:

1. Architectural Woodwork Standards Grade: Match grade indicated for doors.
2. Wood Species and Cut: Match species and cut indicated for wood doors unless otherwise indicated.
3. Wood Moisture Content: As recommended by Architectural Woodwork Standards.
4. Profile: Single rabbet unless indicated otherwise on Drawings.

B. Construction: Solid lumber, fire-retardant particleboard, or fire-retardant medium density fiberboard (MDF) with veneered exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated on Drawings.

2.9 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

   a. Do not trim stiles and rails in excess of limits permitted for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
3. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Seal edges of doors, edges of cutouts, and mortises with sealer coat after fitting and machining.

D. Glazed Openings:

1. Trim openings indicated for glazing with solid-wood moldings, with one side removable. Miter wood moldings at corner joints.
2. Factory install glazing in doors, complying with Division 08 Section Glazing. Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C920. Secure glass in place with removable wood moldings. Miter wood moldings at corner joints.

E. Transom and Side Panels:

1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

2.10 FACTORY PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Division 09 Section Painting.

2.11 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on edges of cutouts, and mortises.

B. Factory finish doors, unless indicated otherwise.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Match grade indicated for doors.
2. Finish:

a. Architectural Woodwork Standards System 5, varnish, conversion.

3. Staining, Effect and Sheen: Match Architect's sample, as scheduled or indicated in Design Selections.

D. Opaque Finish:

1. Architectural Woodwork Standards Grade: Match grade indicated for doors.
2. Finish:

a. Architectural Woodwork Standards System 5, Varnish, Conversion.

3. Color and Sheen: Match Architect's sample, as scheduled or indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

3.2 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work

3.3 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Hardware: For installation, see Division 8 Section Door Hardware.

C. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

D. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3.2 mm in 2400 mm).
2. Anchor frames to anchors or blocking built in or directly attached to substrates.
   a. Secure with countersunk, concealed fasteners and blind nailing.
   b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
      1) For factory-finished items, use filler matching finish of items being installed.
3. Install fire-rated doors and frames according to NFPA 80.
4. Install smoke- and draft-control doors according to NFPA 105.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

1. Clearances:
   a. Head, Jambs and Pairs of Doors: Provide 1/8-inch (3.2 mm) maximum at heads, jambs, and between pairs of doors.
   b. Between Bottom of Door and Top of Threshold: Where threshold is shown or scheduled, provide 1/4-inch (6.4 mm) maximum from bottom of door to top of threshold unless otherwise indicated.

c. Between Bottom of Door and Top of Finished Floor Material - No Threshold: Provide 3/4-inch (19 mm) maximum from bottom of door to top of finished floor material unless otherwise indicated on Drawings.
d. Between Bottom of Door and Top of Finished Floor Material - No Threshold and Bottom of Door is more than 38 inches (965 mm) above the Finished Floor: Provide 3/8-inch (10 mm) maximum from bottom of door to top of finished floor material or comply with manufacturer's door labeling procedure.

F. Factory- Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.4 FIELD QUALITY CONTROL

A. Contractor Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

a. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

C. Contractor Inspections:

1. Provide inspection of installed Work through AWI's Quality Certification Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.

3.5 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

3.6 FINISH SCHEDULE

A. Wood Veneer Faced Doors for Transparent Finish:

1. Species and Cut Selection: Match sample accepted by Architect.
2. Species and Cut Selection:
3. Finish: Match sample accepted by Architect.

4. Finish: As follows:

    a. Grade: Premium.
    b. Product Quality Standard Finish Designation:

        1) AWI conversion varnish system.
        2) WI System 4 clear conversion varnish system.

    c. Staining: Match sample accepted by Architect.
    d. Effect: Open-grain finish.
    e. Effect: Filled finish.
    f. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
    g. Sheen: Satin.

B. Doors for Opaque Finish:

1. Finish: <Insert selection here> Match sample accepted by Architect.
2. Finish:
3. Finish: As follows:

    a. Grade: Premium.
    b. Product Quality Standard Finish Designation:

        1) AWI conversion varnish.
        2) WI System 4 clear conversion varnish.

    c. Color: Match sample accepted by Architect.
    d. Sheen: Semigloss.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 083113
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Access doors and frames and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Ceiling Coordination Drawings for Access Doors at Ceilings: Furnish reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other. Indicate method of attaching door frames to surrounding construction.

D. Samples for Verification Purposes: For each door face material, at least 3 in by 5 in (75 mm by 125 mm) in size, in specified finish.

E. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. ASTM E 119 or UL 263 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Metal Doors and Frames:

a. Acudor Products, Inc.
b. Babcock-Davis.
c. Dur-Red Products.
d. J. L. Industries, Inc.
e. Karp Associates, Inc.
f. Larsen's Manufacturing Company.
g. Maxam Metal Products, Ltd.
h. Milcor Inc.
i. Nystrom Building Products.
j. Williams Brothers Corporation of America.

2. Glass-Fiber-Reinforced Gypsum (GFRG) Doors and Frames:

a. Chicago Metallic Corporation.
b. Nystrom Building Products.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36 / A 36M.

1. ASTM A 123 / A 123M, for galvanizing steel and iron products.
2. ASTM A 153 / A 153M, for galvanizing steel and iron hardware.

B. Steel Sheet: Uncoated cold-rolled steel sheet substrate complying with ASTM A 1008 / A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated (Galvanized) Steel Sheet: ASTM A 653 / A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc

coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924 / A 924M.

D. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning", to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning", or SSPC-SP 8, "Pickling".
2. Surface Preparation for Metallic-Coated (Galvanized) Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

E. Drywall Beads: Edge trim formed from 0.0299 in (0.7 mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

F. Plaster Beads: Casing bead formed from 0.0299 in (0.7 mm) zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.4 STAINLESS-STEEL MATERIALS

A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.

1. Finish: Directional No. 4 Satin Finish.

2.5 ALUMINUM MATERIALS

A. Aluminum Extrusions: ASTM B 221 / B 221M, Alloy 6063-T6.

1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632 / B 632M, Alloy 6061-T6.

1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Aluminum Sheet: ASTM B 209 / B 209M, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness indicated representing specified thickness according to ANSI H35.2 / H35.2(M).

1. Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

2.6 GLASS-FIBER-REINFORCED GYPSUM MATERIALS

A. Fabrications: Molded, glass-fiber-reinforced gypsum units complying with ASTM C 1381 / C 1381M.

2.7 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Non-rated Flush Access Doors and Frames with Exposed Trim:

1. Locations:

a. Masonry wall surfaces.
b. Ceramic tile wall surfaces.

2. Fabricated from one of the following as scheduled at the end of this Section.

a. Steel sheet.
b. Metallic-coated (galvanized) steel sheet.
c. Stainless-steel sheet.

3. Door: Minimum 0.075 in (1.9 mm) thick sheet metal, set flush with exposed face flange of frame.
4. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with 1-1/4 in (32 mm) wide, surface-mounted trim.
5. Hinges: Continuous piano.
6. Lock: Key-operated cylinder.
7. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
8. Basis of Design: Nystrom Building Products, Model NT.

B. Non-rated Flush Access Doors and Trimless Frames:

1. Locations: Wall and ceiling surfaces as scheduled.

a. Gypsum board wall and ceiling surfaces.
b. Plaster wall and ceiling surfaces.

2. Fabricated from one of the following as scheduled at the end of this Section.

a. Steel sheet.
b. Metallic-coated (galvanized) steel sheet.
c. Stainless-steel sheet.

3. Door: Minimum 0.075 in (1.9 mm) thick sheet metal, set flush with surrounding finish surfaces.
4. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with drywall bead flange.
5. Hinges: Continuous piano.
6. Lock: Key-operated cylinder.
7. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
8. Basis of Design: Nystrom Building Products, Model NW or NP as applicable.

C. Non-rated Recessed Access Doors and Trimless Frames:

1. Locations:

a. Gypsum board wall and ceiling surfaces.
b. Plaster wall and ceiling surfaces.

2. Fabricated from one of the following as scheduled at the end of this Section.

a. Steel sheet.
b. Metallic-coated (galvanized) steel sheet.
c. Stainless-steel sheet.

3. Door: Minimum 0.060 in (1.5 mm) thick sheet metal in the form of a pan recessed 5/8 in (15 mm) for infill.
4. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with finishing bead and only frame edge exposed.
5. Hinges: Concealed piano hinge or spring-loaded, concealed-pin type pivoting rod hinge.
6. Lock: Key-operated cylinder with plastic grommet for access through pan recess.
7. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
8. Basis of Design:

a. Gypsum Board Infill: Nystrom Building Products, Model RW.
b. Plaster Infill: Nystrom Building Products, Model RP.

D. Non-rated, Glass-Fiber-Reinforced Gypsum (GFRG) Flush Access Doors and Trimless Frames, Concealed Hinge:

1. Locations:

a. Gypsum board wall and ceiling surfaces as scheduled.
b. Locations indicated on Drawings.

2. Door: Glass fiber reinforced gypsum door, 5/8-inch (16 mm) deep, rounded corners.
3. Frame: Glass fiber reinforced gypsum frame
4. Hinges: Concealed.
5. Lock: Key-operated cylinder.
6. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
7. Basis of Design: Nystrom Building Products; GFRR/GFRS Concealed Hinge Access Doors.

E. Non-rated, Glass-Fiber-Reinforced Gypsum (GFRG) Flush Access Doors and Trimless Frames:

1. Locations:

a. Gypsum board ceiling surfaces as scheduled.
b. Locations indicated on Drawings

2. Door: 1/8 in (3 mm) to 3/16 in (5 mm) thick glass-fiber-reinforced gypsum removable panel with rounded corners.
3. Frame: 1/8 in (3 mm) to 3/16 in (5 mm) thick glass-fiber-reinforced gypsum with 3 in (75 mm) wide exposed frame.
4. Hinges: None.
5. Lock: None.
6. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
7. Basis of Design: Chicago Metallic Corporation; GRG Access Doors, Model 8502.00.

F. Non-rated, Flush, Gasketed Draft Stop Access Doors and Trimless Frame:

1. Locations: Gypsum board ceiling surfaces as scheduled.
2. Fabricated from: Steel sheet.
3. Door: Minimum 0.075 in (1.9 mm) thick sheet metal, set flush with surrounding finish surfaces.
4. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with drywall bead flange.
5. Hinge: Concealed piano hinge or spring-loaded, concealed-pin type pivoting rod hinge.
6. Lock: Key-operated cylinder.
7. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
8. Options: Gasketing installed.
9. Basis of Design: Nystrom Building Products; Model DWK.

G. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim:

1. Locations:

a. Masonry wall surfaces.
b. Ceramic tile wall surfaces.

2. Fabricated from one of the following as scheduled at the end of this Section.

a. Steel sheet.
b. Metallic-coated (galvanized) steel sheet.
c. Stainless-steel sheet.

3. Fire-Resistance Rating: Not less than 1-1/2 hours.
4. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
5. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 in (0.9 mm).
6. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with 1 in (25 mm) wide, surface-mounted trim.
7. Hinges: Continuous piano.
8. Automatic Closer: Spring type.
9. Latch: Self-latching device operated by flush key with interior release.
10. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
11. Basis of Design: Nystrom Building Products, Model IT.

H. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames:

1. Locations:

   a. Gypsum board wall and ceiling surfaces.
   b. Plaster wall and ceiling surfaces.

2. Fabricated from one of the following as scheduled at the end of this Section.

   a. Steel sheet.
   b. Metallic-coated (galvanized) steel sheet.
   c. Stainless-steel sheet.

3. Fire-Resistance Rating: Not less than 1-1/2 hours.
4. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
5. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 in (0.9 mm).
6. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with drywall bead.
7. Hinges: Continuous piano.
8. Automatic Closer: Spring type.
9. Latch: Self-latching device operated by flush key with interior release.
10. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
11. Basis of Design:

   a. Gypsum Board: Nystrom Building Products, Model IW.
   b. Plaster: Nystrom Building Products, Model IP.

2.8 FLOOR ACCESS DOORS AND FRAMES

A. Floor Doors, General: Equip each door with adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with red vinyl grip that allows for one-handed closure, and recessed lift handle.

B. Watertight Aluminum Floor Door: Single-leaf opening. Extruded-aluminum gutter frame with NPS 1-1/2 (DN 40) drainage coupling and 1/4 in (6 mm) thick, diamond-pattern, aluminum tread plate door; watertight; loading capacity to support 300-lbf/sf (14.4-kN/sm) pedestrian live load. Aluminum mill finish.

1. Hinges: Heavy-duty, aluminum butt hinges with stainless steel pins.
2. Latch: Stainless steel slam latch with removable outside handle.
3. Lock: Keyed deadbolt lock.
4. Hardware Material: Stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and all brackets, hinges, pins, and fasteners.
5. Size: As indicated on drawings.
6. Basis of Design: Nystrom Building Products, Model FDDP.

C. Fire Rated Aluminum Floor Door: Single-leaf opening. 1/4 in (6 mm) thick aluminum frame with neoprene cushion and continuous anchor flange, and 1/4 in (6 mm) aluminum door with 1 in (25 mm) recess to receive minimum 1/2 in (12 mm) concrete and finish flooring material; loading capacity to support 150-lbf/sf (7.2-kN/sm) pedestrian live load. Aluminum mill finish with bituminous coating on exterior of frame.

1. Hinge: Type 316 stainless steel, continuous.
2. Latch: Type 316 stainless steel slam latch with inside cable release handle and outside removable key handle with gasketed cover plug.
3. Spring: Compression spring operators enclosed in telescopic tubes.
4. Hold-Open Arm: Hydraulic hold-open system to automatically hold door in open position.
5. Self-Closing: Self-contained pneumatic automatic close and latch system when temperature exceeds 165 deg F (73.9 deg C).
6. Fire Proofing: Intumescent coating on inside of door and frame.
7. Fire-Resistance Rating: Not less than 2 hours.
8. Finish painted in yellow with wording "FIRE DOOR - DO NOT STORE MATERIALS ON SURFACE".
9. Size: As indicated on drawings.
10. Basis of Design: The Bilco Company, Type FR Fire Rated Door.

D. Aluminum Floor Door: Single-leaf opening. Extruded-aluminum angle frame with 1/4 in (6 mm) thick, diamond-pattern, aluminum tread plate door; nonwatertight; loading capacity to support 300-lbf/sf (14.4-kN/sm) pedestrian live load.

1. Hinges: Heavy-duty, aluminum butt hinges with stainless steel pins.
2. Latch: Stainless steel slam latch with removable outside handle.
3. Lock: Keyed deadbolt lock.
4. Hardware Material: Stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and all brackets, hinges, pins, and fasteners.
5. Size: As indicated on drawings.
6. Basis of Design: Nystrom Building Products, Model FHA.

E. Steel Angle-Frame Floor Door: Single-leaf opening. Galvanized structural-steel frame with 3/16 in (5 mm) thick, diamond-pattern, galvanized structural-steel tread plate door; nonwatertight; loading capacity to support 300-lbf/sf (14.4-kN/sm) pedestrian live load.

1. Hinge: Type 316 stainless steel butt hinges bolted to door and frame.
2. Latch: Type 316 stainless steel slam latch with inside lever handle and outside removable key handle.
3. Spring: Type 316 stainless steel compression springs enclosed in tubes.
4. Hold-Open Arm: Type 316 stainless steel handle that automatically locks door at 90 deg. when opened.
5. Size: As indicated on drawings.
6. Basis of Design: Nystrom Building Products, Model FHS.

2.9 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Gypsum Board Locations: For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
2. Plaster Locations: For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
3. Provide mounting holes in frames for attachment of units to metal framing.
4. Provide mounting holes in frame for attachment of masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

1. Plaster Locations: For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

F. Extruded Aluminum at Floor Doors: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.4 INSTALLATION OF ACCESS DOORS AND FRAMES

A. Frames with Masonry Anchors: Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.5 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.6 ACCESS DOOR SCHEDULE

A. Provide access doors where indicated on the drawings and as follows:

1. Steel Access Doors:

   a. Concealed valves and controls for plumbing and HVAC.
   b. Fire dampers above non-accessible ceilings.
   c. Motor operated doors and grilles above non-accessible ceilings.
   d. Other locations not scheduled below.

2. Gasketed Draft Stop Access Doors:

   a. Ceilings in Restricted Areas of healthcare facilities, monolithic ceilings as required by code and as indicated on drawings. These areas include but are not limited to: operating rooms, central sterile areas, sub sterile areas, isolation rooms and clean utility rooms.

3. Fire-Rated Steel Access Doors:

   a. Rated walls and ceilings.

4. Metallic-Coated (Galvanized) Steel Access Doors:

   a. Exterior locations.

5. Stainless Steel Access Doors:

   a. Ceramic tile and other damp locations.

6. Glass-Fiber-Reinforced Gypsum (GFRG) Access Doors:

   a. Gypsum board walls and ceilings.

7. Fire-Rated Floor Access Doors:

   a. Rated floors.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 083213
SLIDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sliding aluminum-framed glass door systems and accessories necessary to complete installation.

B. Related Requirements:

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

C. Refer to Division 8 Section "Glazing" for engineered transition assemblies.

1.2 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability,

substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Prepared by manufacturer, not installer.

a. Shop drawings not prepared by manufacturer shall include manufacturer's written approval on shop drawings.

2. Include typical unit elevations at 1/2 in (12 mm) scale and details at full scale.
3. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
4. Indicate where and how the system deviates from Contract Documents.
5. Shop drawings shall be certified by an approved qualified engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
6. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and certified by an approved qualified engineer sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.
7. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.
8. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
9. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum framing systems, showing the following:

a. Mullion details, including reinforcement and stiffeners.
b. Joinery details, including concealed welds.
c. Anchorage.
d. Expansion provisions.
e. Glazing details.
f. Flashing and drainage details.
g. Weather-stripping details.
h. Thermal-break details.

C. Samples for Verification: For components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 in (50 by 100 mm).
2. Exposed Hardware: Full-size units.

D. Full-Size Sample: Architect reserves the right to require full size sample less glass that show fabrication techniques, workmanship, and design of hardware and accessories.

E. Product Schedule: Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Energy Performance Certificates: For sliding glass door systems, accessories, and components.

1. Basis for Certification: Certified by manufacturer for energy performance ratings as determined in accordance with NFRC.

D.

E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

F. Field Quality Control Reports: Written report of testing and inspection required by ""Field Quality Control".

G. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

D. Fenestration Standard: Fenestration Standard: Comply with, AAMA/NWWDA 101/I.S.2 for windows, doors, and skylights for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

E. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.

1. Safety-Glass Labeling: Subject to compliance with requirements, permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety-glass standard with which glass complies.

F. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

G. Preconstruction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition.

1. Test a minimum five production-run samples each of metal, glazing, and other material.
2. Prepare samples using techniques and primers required for installed assemblies.
3. Perform tests under environmental conditions that duplicate those under which assemblies will be installed.
4. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

H. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.8 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review inspection and testing requirements.
   e. Review environmental conditions and procedures for coping with unfavorable conditions.
   f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver sliding aluminum-framed glass doors and other exposed elements in padded blankets or other approved protective wrapping.

B. Protect finish surfaces from damage during handling and installation.

1.10 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.11 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.12 WARRANTY

A. Manufacturer’s Warranty: Furnish manufacturer’s written material and labor warranty signed by an authorized representative using manufacturer’s standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

   1. Failures include, but are not limited to, the following:

      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Deterioration of metals and other materials beyond normal weathering.
      e. Water penetration through fixed glazing and framing areas.
      f. Failure of operating components.

   2. Warranty Period: Manufacturer shall warrant the products listed below to be free from material and labor Defects for the following period of time:

      a. Sliding Door: 5 years from date of Substantial Completion.
      b. Glazing: 10 years from date of Substantial Completion.

B. Installer’s Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer’s standard form agreeing to provide labor required to repair or

replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

C. Factory Applied Finish Warranty: Furnish manufacturer™™s written warranty signed by an authorized representative using manufacturer™™s standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Coverage includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

D. Factory Applied Finish Warranty for Anodic Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Arcadia Inc.
2. EFCO Corporation, a Pella Company.
3. Kawneer North America; an Alcoa Company.
4. Oldcastle Building Envelope.
5. Peerless Architectural Windows & Doors.
6. YKK AP America Inc.
7. Wausau Window and Wall Systems.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Sliding Aluminum Framed Glass Doors: Arcadia Inc; ULT5000 Series Architectural Sliding Doors.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440, as required to comply with most stringent structural, air-infiltration, and water-resistance performance requirements based on the largest sliding door size for the Project and as follows:

1. Minimum Performance Class: Class AW.
2. Minimum Performance Grade: Not less than the highest design pressure required for Project.

C. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

D. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:

1. Live Load Deflection: Accommodate differential vertical deflection of floors:

a. Deflection: As indicated on Drawings.

E. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

F. Deflection of Framing Members: At design wind load in accordance with the Building Code.

1. Deflection Normal to Wall Plane: Edge deflection of individual glazing lites limited to 1/175 for glass edge lengths up to 13 feet 6 inches (4.1 m), when designed in accordance with AAMA TIR A11-15 and tested in accordance with ASTM E 330/E330M-14, or structural computations.

G. Structural Test Performance: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

H. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf (580 Pa).

1. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
2.

I. Energy Performance: Certified or labeled by manufacturer for energy performance ratings in accordance with NFRC.

1. Thermal Transmittance (U-Factor): U-factor as determined in accordance with NFRC 100.

a. Maximum U-Factor: As indicated on Drawings, comply with building energy performance model for this project.

2. Solar Heat Gain Coefficient (SHGC): Solar Heat Gain Coefficient as determined in accordance with NFRC 200.

a. Maximum SHGC: As indicated on Drawings, comply with building energy performance model for this project.

3. Air Leakage:

a. Air leakage for the system of not more than 0.30 cfm/sf at a minimum static-air-pressure differential of 6.24 lbf/sf (300 Pa) when tested in accordance with AAMA / WDMA / CSA 101 / I.S.2 / A440, Air Leakage Resistance Test.

4. Condensation Resistance: Condensation resistance as determined in accordance with NFRC 500.

a. No condensation allowed under design conditions indicated.

J. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows:

1. Outdoor-Indoor Transmission: Minimum Class 38.

K. Windborne-Debris-Impact-Resistance Performance: Comply with missile impact and cyclic-pressure testing requirements for Wind Zone and facility type.

L. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

M. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 MATERIALS

A. Aluminum Extrusions: Provide alloy and temper recommended by sliding aluminum-framed glass door manufacturer for strength, corrosion resistance, and application of required finish. Comply with AAMA/WDMA/CSA 101/I.S.2/A440.

B. Fasteners: Provide fasteners of aluminum, nonmagnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive for SC 3 severe service conditions and compatible with members, trim, hardware, anchors, and other components of sliding aluminum-framed glass doors. Comply with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding aluminum-framed glass doors, complying with ASTM B 456 or ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Provide aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel reinforcing members that are noncorrosive for SC 3 severe service conditions and that comply with AAMA/WDMA/CSA 101/I.S.2/A440; provide sufficient strength to withstand design pressure indicated.

E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when sliding aluminum-framed glass door is closed.

F. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.

1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet, or polypropylene-coated material. Comply with AAMA 702.

G. Sealant: For sealants required within fabricated sliding doors, provide sliding aluminum-framed glass door manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

H. Dividers (False Muntins): Provide extruded-aluminum divider grilles in designs indicated for each sash lite.

1. Type:

a. Permanently located at exterior lite.
b. Permanently located between insulating-glass lites.

2. Pattern: As indicated on Drawings.
3. Profile: As selected by Architect from manufacturer's full range.
4. Finish: Match aluminum appearance.

2.5 SLIDING ALUMINUM-FRAMED GLASS DOORS

A. Frames and Door Panels: Fabricated from aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

2.6 GLAZING

A. Glass and Glazing System: Comply with Division 08 Section "Glazing" for glass and glazing requirements.

B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal and complies with performance requirements.

2.7 HARDWARE

A. General: Provide manufacturer's standard hardware, fabricated from aluminum, stainless steel or other corrosion-resistant material compatible with aluminum complying with AAMA 907 and designed to smoothly operate, tightly close, and securely lock sliding aluminum-framed glass doors. Do not use aluminum in frictional contact with other metals. Where exposed, provide extruded, cast, or wrought aluminum.

B. Roller Assemblies: Provide movable panels with adjustable-height roller assemblies, complying with AAMA 906, consisting of self-lubricating, dual tandem manufacturer's standard stainless steel ball-bearing rollers; with two roller assemblies per panel.

C. Threshold and Sill Cap/Track: Provide extruded-aluminum threshold and stainless steel track of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior; with manufacturer's standard finish.

D. Door Pulls: Provide manufacturer's standard extruded-aluminum pull grips.

1. Color and Finish: As selected by Architect from manufacturer's full range.

E. Lock: Install manufacturer's keyed cylinder lock and multipoint locking device on each movable panel, lockable from the inside. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.

1. Keying System: All cylinders keyed alike.

2.8 INSECT SCREENS

A. General: Design sliding aluminum-framed glass doors to accommodate screens in a tight-fitting, removable arrangement, fully integrated with door frame. Provide screen for each operable door panel.

B. Aluminum Frames: Manufacturer's standard extruded aluminum profile fabricated from aluminum alloy complying with SMA 1201 and finished to match door frame. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Finish: Match aluminum appearance.

C. Glass-Fiber Mesh Fabric: ASTM D 3656, 18 by 14 or 18 by 16 count per square in (645 sq. mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration.

1. Color and Finish: As selected by Architect from manufacturer's full range.

D. Hardware: Manufacturer's standard noncorrosive metal.

1. Lock: Manufacturer's standard pull and keyless locking device on each movable panel, lockable from inside only, designed to allow unobstructed movement of panel across adjacent panel.

2.9 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of sliding aluminum-framed glass doors, as specified in Division 07 Section "Joint Sealants".

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mils (0.762 mm) thickness per coat.

C. Thermal Insulating Materials: As specified in Division 07 Section "Thermal Insulation".

2.10 FABRICATION

A. General: Fabricate in sizes indicated. Include a complete system for assembling components and anchoring doors.

B. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling panel framing.

C. Weather Stripping: Provide operable panels with a double row of sliding weather stripping in horizontal rails and double-row weather stripping in meeting or jamb stiles. Provide compression-type weather stripping at the perimeter of each movable panel where sliding-type weather stripping is not appropriate.

1. Provide weather stripping locked into extruded grooves in door panels or frames.

D. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to exterior.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

F. Factory-Glazed Fabrication: Glaze doors in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.

G. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and with glazing system indicated. Provide glazing stops to match panel frames.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Selections: As scheduled or as indicated in Design Selections.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

D. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting

performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
3. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight installation.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF SLIDING ALUMINUM-FRAMED GLASS DOORS

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.

B. Install sliding aluminum-framed glass doors level, plumb, square, true to line, without distortion, warp or rack of frames and panels, or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

D. Install sliding aluminum-framed glass doors and components to drain condensation, water penetrating joints, and moisture migrating within doors to the exterior.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

A. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.6 ADJUSTING, CLEANING, AND PROTECTION

A. Lubricate hardware and moving parts.

B. Adjust operating panels and screens (if applicable) to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and a weathertight closure.

C. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

D. Clean aluminum surfaces immediately after installing sliding doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, and clean surfaces.

E. Clean glass immediately after installing sliding aluminum-framed glass doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

F. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

G. Protect sliding door surfaces from contact with contaminating substances resulting from construction operations. During construction, monitor sliding door surfaces adjacent to and below exterior concrete and masonry surfaces for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact sliding door surfaces, remove contaminants immediately according to manufacturer's written instructions.

H. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.

I. Replace damaged components.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 083219
MEDICAL SLIDING ALUMINUM FRAMED DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Interior sliding aluminum-framed glass door systems and accessories necessary to complete installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: For components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below.

1. Exposed Finishes: 4 by 4 inches (100 by 100 mm).

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

C. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.

1. Safety-Glass Labeling: Subject to compliance with requirements, permanently mark glass with certification label of the SGCC or another certification agency acceptable to

authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety-glass standard with which glass complies.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store and handle materials in accordance with manufacturer’s instructions

C. Keep materials in manufacturer’s original, unopened containers and packaging until installation.

D. Store materials in clean, dry area indoors.

E. Protect finish surfaces from damage during handling and installation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "ADA Standards for Accessible Design", ICC A117.1 “Standard for Accessible and Usable Buildings and Facilities” and requirements of local Authorities Having Jurisdiction.

C. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 MEDICAL SLIDING ALUMINUM-FRAMED DOORS

A. General: Manufacturer standard interior aluminum framed sliding door system designed to fit directly within wall opening.

1. Basis of Design: AD Systems; InsetSlide High Performance Sliding Door System.

B. Wall Thickness: As indicated on Drawings.

C. Frames: Manufacturer standard extruded aluminum frame profile designed to wrap partition with integral vertical jamb (stile pocket).

1. Finish: Manufacturer standard fluoropolymer finish, comply with AAMA 2604.

a. Color Selection: As selected by Architect from Manufacturer standard colors.

D. Doors: Factory machine doors for hardware including pilot and function holes.

1. Stile and Rail Aluminum Door: Manufacturer’s standard glazed doors 1-3/4 inch thick extruded-aluminum tubular stile and rail members, welded and bolted corner connections.

a. Vertical Stiles: 3-1/2 inches wide plus 1/2-inch stop.
b. Horizontal Rails: 3-1/2 inches wide plus 1/2-inch stop.
c. Bottom Rail: 10-inches high.
d. Glazing: Manufacturer standard monolithic clear tempered.

2. Flush Wood Door: Manufacturer’s standard flush wood doors, 1-3/4 inch thick. Refer to Division 08 Section Solid Core Flush Wood Doors for requirements.

a. Vertical Stiles: 6-inches wide plus 1/2-inch stop.
b. Horizontal Rails: 6-inches wide plus 1/2-inch stop.
c. Bottom Rail: 10-inches high.
d. Glazing: Manufacturer standard monolithic clear tempered.

E. Door Components:

1. Single Top Track: Manufacturer's standard extruded aluminum track.
2. Valances: Extruded aluminum with integral end caps, match frame finish.
3. Top Rollers: Tandem nylon roller sized to match door weight.
4. Concealed Floor Guide: Integral jamb floor guide.
5. Soft-Closer: Self-closing, soft-closing damper mechanism at both sides of door leaf.
6. Handles: Manufacturer standard ladder pull, 16-inches long x 1-inch diameter, US32D satin stainless-steel finish.

F. Door Latching: Self-Latching with Single Action Egress (Return to Door Tubular Lever), US32D satin stainless-steel finish.

1. Passage:

a. Basis of Design: AD6010 Passage, Back-to-Back Lever Trim.
b. Locations: Provide latching hardware as indicated or scheduled in the Door Schedule, refer to Drawings.

2.5 FABRICATION

A. General: Fabricate in sizes indicated. Include a complete system for assembling components and anchoring doors.

B. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Selections: As scheduled or as indicated in Design Selections.

B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2604.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF SLIDING ALUMINUM-FRAMED GLASS DOORS

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.

B. Install sliding aluminum-framed glass doors level, plumb, square, true to line, without distortion, warp or rack of frames and panels, or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.6 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

B. Clean sliding doors immediately after installing. Comply with manufacturer's written recommendations for final cleaning and maintenance. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect sliding door surfaces from damage resulting from construction operations. Remove contaminants immediately according to manufacturer's written instructions.

E. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.

F. Replace damaged components.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 083343
OVERHEAD COILING SMOKE AND FIRE CURTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Overhead coiling protective curtain assemblies including supplementary items necessary to complete the Work required for installation.

1. Smoke-protective curtain assemblies for elevator entrances.
2. Smoke- and fire-protective curtain assemblies for elevator entrances.
3. Fire- and smoke-protective curtain assemblies for fixed openings.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
3. Include ratings, operating components, electrical characteristics, control systems, and furnished specialties and accessories.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include details of curtain assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location of each field connection.
2. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
3. Show locations of controls, detectors, and other accessories.
4. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.

1. Curtain guide.
2. Bottom bar.

D. Product Schedule: For curtain assemblies.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Evaluation Reports: For curtain assemblies, from ICC-ES or other agency acceptable to Authorities Having Jurisdiction.

C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

D. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For curtain assemblies to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Smoke-Protective Curtain Assembly Inspector Qualifications: Inspector for field quality control inspections of fire- and smoke-protective curtain assemblies complying with NFPA 105.

D. Smoke- and Fire-Protective Curtain Assembly Inspector Qualifications: Inspector for field quality control inspections of fire- and smoke-protective curtain assemblies complying with NFPA 80 and NFPA 105.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate curtain assemblies with power, signal, fire-alarm, and smoke-detection systems specified in Division 26 and Division 28.

C. Coordinate elevator curtain assemblies with elevator hoistway door frames specified in Division 14.

D. Coordinate curtain assemblies with ceilings for operational clearances and maintenance access requirements.

E. Coordinate curtain assemblies with walls for support requirements, rating continuity above ceilings, and recessed wall switches.

F. Coordinate requirements for metal supports required for curtain assemblies.

1.9 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials

and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the installation to be free from defects for a period of 2 years from date of Substantial Completion.

1.10 MAINTENANCE

A. Continuing Maintenance Proposal: In the form of a standard yearly maintenance agreement.

1. Manufacturer's authorized service representative to test, adjust, and maintain the fire-protective assemblies once per year as required by NFPA.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Door Systems Inc.
2. Smoke Guard, a CSW Industries Company.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Obtain operators and controls from curtain manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of overhead doors representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Smoke Protective Curtain Assemblies: Provide smoke-protective curtains that are listed and labeled with the letter "S" on the rating label by a qualified testing agency for smoke- and draft-control based on testing in accordance with UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m) of opening at 0.10 inch wg (24.9 Pa) for both ambient and elevated temperature tests.

C. Smoke Protection: Complying with NFPA 80; listed and labeled by qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible in accordance with UL 10D.

D. Smoke- and Fire-Protective Curtain Assemblies: Complying with NFPA 80; listed and labeled by qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible in accordance with UL 10D.

E. Curtain Fabric Fire-Test-Response Characteristics: Provide products that pass NFPA 701, as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

2.4 SMOKE-PROTECTIVE CURTAIN ASSEMBLIES FOR ELEVATOR ENTRANCES

A. Alarm-activated transparent-film smoke curtain assembly complying with ICC-ES AC77.

1. Basis-of-Design Product: One of the following for widths and heights indicated on Drawings.

a. Smoke Guard; Model M400.
b. Smoke Guard; Model M600.
c. Door Systems; Model DSI-600 Elevator Smoke Curtain.

B. Smoke Containment: Assemblies complying with UL 1784 for air leakage and requirements of ASME 17.1/CSA B44.

C. Curtain: Manufacturer's standard film with flame-spread and smoke-developed indexes of 25 and 450, respectively, when tested in accordance with ASTM E84.

D. Operation: Automatic operation with controlled descent and motorized rewind.

E. Curtain Attachment: Curtain shall form a pressure-resisting seal by one of the following methods:

1. Magnetic Adhesion: With Type 430 ferritic stainless steel elevator door frames, use magnets for closure with door frame.
2. Auxiliary Rails: With magnetic closure of curtain with incompatible elevator door frame material, provide magnetic stainless-steel cladding for door frame, formed from ASTM A240/A240M, Type 430 ferritic stainless steel.

a. Finish: Match stainless steel elevator door frame.

3. Captured Side Guides: Formed from galvanized-steel sheet complying with ASTM A653/A653M with integral pressure-retaining tabs.

F. Control System: Provide factory-assembled control unit as required for assembly specified.

1. Include wiring from Motor Control Circuit to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

a. Coordinate Wiring Loop from Group Control Panel to Motor Control Circuit.

2. Fail-safe device deploys on activation of local smoke detector and building fire alarm or testing key switch in compliance with UL 864.
3. Push-to-Exit / Curtain Rewind Switch: Include switch to rewind screen into housing.
4. Motor Operator: Provide factory-assembled electric operation system of size and capacity recommended in writing by curtain manufacturer for assembly specified, with electric

motors and factory-prewired motor controls, control devices, and accessories required for proper operation.

5. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Battery Backup: Manufacturer's standard battery backup and test switch sized for motor power requirements.

G. Housing Type: Sheet metal housings containing support rollers and associated electronics.

1. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

2.5 SMOKE- AND FIRE-PROTECTIVE CURTAIN ASSEMBLIES FOR ELEVATOR ENTRANCES

A. Alarm-activated flame-resistant fabric smoke curtain assembly complying with ICC-ES AC77.

1. Basis-of-Design Product:

a. Smoke Guard; Model M2100 Fire + Smoke.
b. Door Systems; Model DSI-600 Elevator Smoke and Fire Curtain.

B. Smoke Containment: Assemblies complying with UL 1784 for air leakage and requirements of ASME 17.1/CSA B44.

C. Fire-Resistance Rating of Fabric: Comply with UL 10D; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Rating: 1-hour, unless indicated otherwise in door schedule.

D. Curtain: Manufacturer's standard multilayer glass-fiber fabric woven-coated on one or both sides.

E. Operation: Automatic operation with controlled descent and motorized rewind.

F. Roller: Manufacturer's standard curtain roller assembly to contain motor.

G. Weighted Bottom Bar: Provide weighted bottom bar to ensure smooth operation and hold curtain taut.

H. Curtain Guides: As selected by Architect from manufacturer's available standard materials and finishes.

I. Control System: Provide factory-assembled control unit as required for assembly specified.

1. Include wiring from Motor Control Circuit to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

a. Coordinate Wiring Loop from Group Control Panel to Motor Control Circuit.

2. Fail-safe device deploys on activation of local smoke detector and building fire alarm or testing key switch in compliance with UL 864.
3. Push-to-Exit / Curtain Rewind Switch: Include switch to rewind screen into housing.
4. Motor Operator: Provide factory-assembled electric operation system of size and capacity recommended in writing by curtain manufacturer for assembly specified, with electric motors and factory-prewired motor controls, control devices, and accessories required for proper operation.
5. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by a qualified testing agency, and marked for intended location and application.

6. Battery Backup: Manufacturer's standard battery backup and test switch sized for motor power requirements.

J. Automatic-Closing Device: Equip each curtain assembly with an automatic-closing device or holder-release mechanism and governor unit complying with UL 864 and NFPA 105, and an easily tested and reset release mechanism. Automatic-closing device shall be designed for activation by the following:

1. Building fire-detection, smoke-detection, and fire-alarm systems.

K. Housing Type: Sheet metal housings containing support rollers and associated electronics.

1. Manufactured from galvanized steel in accordance with ASTM A653/A653M; rated at the same temperature as the curtain fabric.
2. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

2.6 FIRE- AND SMOKE- PROTECTIVE CURTAIN ASSEMBLIES FOR FIXED OPENINGS

A. Alarm-activated fire- and smoke-protective curtain assemblies restrained by curtain guides at each jamb of an opening.

1. Basis-of-Design Product:

a. Smoke Guard; Model M2500 Fire + Smoke Curtain System.
b. Door Systems; Model C1HR Smoke and Fire Curtain.
c. Door Systems; Model C3HR Smoke and Fire Curtain.

B. Smoke Containment: Assemblies complying with UL 1784 for air leakage.

C. Fire-Resistance Ratings: Comply with ASTM E119 (without hose stream test); testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Rating: As indicated in door schedule.

D. Curtain: Manufacturer's standard multilayer glass-fiber fabric woven-coated on one or both sides.

E. Operation: Automatic operation with controlled descent and motorized rewind.

F. Roller: Cold-formed steel tube conforming to ASTM A500/A500M.

G. Weighted Bottom Bar: Provide weighted bottom bar to ensure smooth operation and hold curtain taut

H. Side Guides: Formed from galvanized-steel sheet conforming to ASTM A653/A653M, with integral pressure-retaining tabs.

I. Control System: Provide factory-assembled control unit as required for assembly specified.

1. Include wiring from Motor Control Circuit to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system

a. Coordinate Wiring Loop from Group Control Panel to Motor Control Circuit.

2. Fail-safe device deploys on activation of local smoke detector and building fire alarm or testing key switch in compliance with UL 864.
3. Push-to-Exit / Curtain Rewind Switch: Include switch to rewind screen into housing.

4. Motor Operator: Provide factory-assembled electric operation system of size and capacity recommended in writing by curtain manufacturer for assembly specified, with electric motors and factory-prewired motor controls, control devices, and accessories required for proper operation.
5. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Battery Backup: Manufacturer's standard battery backup and test switch sized for motor power requirements.

J. Automatic-Closing Device: Equip each curtain assembly with an automatic-closing device or holder-release mechanism and governor unit complying with UL 864 and NFPA 80, and an easily tested and reset release mechanism. Automatic-closing device shall be designed for activation by the following:

1. Building fire-detection, smoke-detection, and fire-alarm systems.

K. Housing Type: Sheet metal housings containing support rollers and associated electronics.

1. Manufactured from galvanized steel in accordance with ASTM A653/A653M; rated at the same temperature as the curtain fabric.
2. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Examine locations of electrical connections.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Preparation: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

C. Smoke-Protective Curtains: Install smoke-protective curtain assemblies in accordance with manufacturer's written installation instructions and NFPA 105.

D. Smoke- and Fire-Protective Curtains: Install in accordance with manufacturer's written installation instructions, NFPA 80, and NFPA 105.

E. Elevator Entrances: Install curtain assemblies for elevator entrances in accordance with ASME 17.1/CSA B44.

F. Power-Operated Curtains: Install in accordance with UL 864.

G. Install anchorage devices to securely fasten assembly to substrate and building framing without distortion or stress.

H. Securely brace components suspended from structure.

I. Fit and align assembly, including vertical guides, level and plumb, to provide smooth operation.

J. Adjust protective curtain assemblies to function smoothly, as recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

a. Prepare and submit separate inspection report for each protective curtain assembly indicating compliance with each item listed in NFPA.

C. Contractor Testing Agency: Engage a qualified opening protective assembly inspector to perform tests and inspections and to furnish reports to Architect.

1. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

a. Test release mechanism, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed curtain. Reset closing mechanism after successful test.
b. Inspections: Inspect each protective curtain assembly in accordance with NFPA.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling smoke curtains.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 083613
SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sectional overhead doors, including supplementary items necessary to complete the Work required for their installation.

1. Provide complete operating door assemblies including door panels, tracks, counterbalance mechanisms, hardware, operators and installation accessories.

B. Related Sections:

1. Field painting is specified in Division 9.
2. Electrical service and connections for power operators and accessories are specified in Division 26.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance
2. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
3. Summary of forces and loads on walls and jambs.
4. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

C. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.

D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1. Glazing.
2. Metal for door sections.
3. Hardware.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Failure of components or operators before reaching required number of operation cycles.
c. Faulty operation of hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
e. Delamination of exterior or interior facing materials.

2. Warranty Period: 5 years from date of Substantial Completion.

B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Amarr Garage Doors.
2. Arm-R-Lite Door Manufacturing Co., Inc.
3. Clopay Building Products Co.
4. Fimble Door Corporation.
5. Haas Door Co.
6. Overhead Door Corporation.
7. Raynor Garage Doors.
8. Wayne-Dalton Corp.
9. Windsor Door; A United Dominion Company.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials

2.3 PERFORMANCE REQUIREMENTS FOR EXTERIOR DOORS

A. General Performance: Comply with performance requirements specified, as determined by testing of overhead doors representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure acting inward and outward as required by local building code and Design Wind Pressure Schedule.

C. Windborne-Debris-Impact-Resistance: Comply with impact resistance testing requirements for Wind Zone.

D. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. (2.03 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to ASTM E 283 or DASMA 105.

2.4 STEEL SECTIONS

A. Construct door sections from galvanized, structural-quality carbon-steel sheets complying with ASTM A 653, commercial quality, with a minimum yield strength of 33,000 psi and a minimum G90 zinc coating.

1. Exterior Section Face: Flat, 0.064 in (1.7 mm) thick (16 gage).
2. Exterior Section Face: Grooved, ribbed, or fluted, 0.040 in (1.0 mm) thick (20 gage).

B. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Fabricate door panels from a single sheet to provide sections not more than 24 in (600 mm) high and nominally 2 in (50 mm) deep. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.

1. For insulated doors, provide door sections with continuous thermal-break construction, separating faces of door.

D. Enclose open section with not less than 0.064 in (1.7 mm) galvanized steel channel end stiles welded in place. Provide not less than 0.064 in (1.7 mm) galvanized intermediate stiles, cut to door section profile, spaced at not more than 48 in (1200 mm) o.c., and welded in place.

E. Reinforce bottom section with a continuous channel or angle complying with bottom section profile and allowing installation of astragal.

F. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized steel bars, struts, trusses or strip steel, formed to depth and bolted or welded in place.

G. Provide reinforcement for hardware attachment.

H. Insulation: Manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation, foamed in place to completely fill inner core of section, pressure bonded to face sheets to prevent delamination under wind load and with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, according to ASTM E 84. Provide manufacturers standard inside face sheet to enclose insulation completely, with no exposed insulation material evident.

I. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints, and free of warp, twist, and deformation.

J. Finishes, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish galvanized steel door s it.

1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

2.5 ALUMINUM SECTIONS

A. Construct door framing sections with extruded-aluminum shapes, complying with ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, with wall thickness not less than 0.065 in (1.7 mm) for door section 1-3/4 in (44 mm) deep. Fabricate sections with stile and rail dimensions and profiles shown. Join stiles and rails by welding or with concealed, 1/4 in (6 mm) minimum-diameter, aluminum or nonmagnetic stainless-steel through bolts, full height of door section. Form meeting rails to provide a weathertight-seal joint. Provide reinforcement for hardware attachment.

B. Fabricate panels of aluminum sheet, complying with ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, not less than 0.050 in (1.25 mm) thick, set in continuous vinyl channel retained with rigid, snap-in, extruded-vinyl moldings or with rubber or neoprene glazing gasket with aluminum stop.

C. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

D. Finishes, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's

written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

a. Aluminum Finish: Comply with AAMA 2604 requirements for pigmented organic coatings applied to aluminum extrusions and panels.

3. Anodized Aluminum Finish: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

a. Clear Anodic Finish for Exterior Units: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
b. Clear Anodic Finish for Interior Units: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
c. Color Anodic Finish for Exterior Units: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
d. Color Anodic Finish for Interior Units: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

1) Color: As scheduled or as incidated in Design Selections.

4. High-Performance, Organic, Aluminum Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating; Organic Coating: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

a. Color: As scheduled or as incidated in Design Selections.

2.6 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Provide manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653, for minimum G90 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 2 in (50 mm) o.c. for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.

B. Track Reinforcement and Supports: Provide galvanized steel track reinforcement and support members, complying with ASTM A 36 and ASTM A 123. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

C. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

D. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and at top of overhead door.

1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
2. In addition, provide continuous flexible seals at door jambs for a weathertight installation.

E. Windows: Provide windows of type and size indicated and in arrangement shown. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors. Provide removable stops of same material as door section frames.

1. Size: Manufacturer's standard panel for type of glazing indicated.
2. Tempered Glass: 3 mm thick and complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q3.
3. Clear Polycarbonate Plastic: 3 mm thick, transparent, fire-retardant, UV-resistant, polycarbonate sheet manufactured by extrusion process.
4. Insulating Glass Units: Manufacturers' standard unit with tempered glass lites complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q3.

2.7 HARDWARE

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Provide heavy-duty galvanized steel hinges, of not less than 0.0747in (1.8 mm) thick uncoated steel, at each end stile and at each intermediate stile, per manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 ft (4.8 m) in width, unless otherwise recommended by door manufacturer.

C. Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3 in (75 mm) diameter roller tires for 3 in (75 mm) track, 2 in (50 mm) diameter roller tires for 2 in (50 mm) track, with case-hardened steel tires.

D. Push/Pull Handles: Provide galvanized steel lifting handles on each side of door.

E. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks, operable from inside only.

1. Lock cylinder is specified in another Division 8 Section “Door Hardware”.

F. Chain Lock Keeper: Suitable for padlock.

2.8 COUNTERBALANCING MECHANISM

A. Torsion Spring: Operation by torsion-spring counterbalance mechanism consisting of adjustable-tension torsion springs, fabricated from oil-tempered-steel wire complying with ASTM A 229, Class II, mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for minimum operation – cycle requirements specified.

B. Cable Drums: Provide cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide 1 additional midpoint bracket for shafts up to 16 ft (4.8 m) long and 2 additional brackets at one-third points to support shafts more than 16 ft (4.8 m) long, unless closer spacing is recommended by door manufacturer.

C. Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.

D. Bracket: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.

E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.9 MANUAL DOOR OPERATORS

A. Push-up Operation: Provide lift handles and pull rope for raising and lowering doors, operating with not more than 25-lbf lift or pull.

B. Direct-Drive Chain-Hoist Operator: Provide side-mounted unit consisting of endless steel hand chain, cast-iron chain pocket wheel, and guard, mounted on counterbalance shaft. Operate with not more than 35-lbf pull.

C. Reduction-Drive Chain-Hoist Operator: Provide side-mounted unit consisting of endless steel hand chain, chain pocket wheel with at least 3:1 reduction unit, and roller chain and sprocket drive or suitable gearing, end mounted on counterbalance shaft. Operate with not more than 35-lbf pull.

2.10 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operational life specified, complete with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation. Comply with NFPA 70.

B. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level.

1. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
2. Provide safety interlock switch to disengage power supply when door is locked.

C. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

D. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

E. Door-Operator Type: Unless otherwise recommended by door manufacturer because of door size or opening frequency, provide trolley or drawbar type, with V-belt primary drive, chain and sprocket secondary drive, and quick disconnect-release for manual operation.

F. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or considering service factor.

1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
5. Provide totally enclosed, nonventilated or fan-cooled motors, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure for exterior locations.

G. Remote-Control Station: Provide momentary-contact, 3-button control station with push-button controls labeled "Open," "Close," and "Stop." Locate on interior side adjacent to door.

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
2. Provide exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.

H. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Provide electrically actuated automatic bottom bar.
b. Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.

I. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

B. Fasten vertical track assembly to framing at not less than 24 in (600 mm) o.c. Hang horizontal track from structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

D. Adjust belt-driven motors as follows:

1. Use adjustable motor-mounting bases for belt-driven motors.
2. Align pulleys and install belts.
3. Tension belt according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

3.6 FINISH SCHEDULE

A. Color and Gloss:

B. Color and Gloss: Match sample accepted by Architect.

C. Color and Gloss: As selected by Architect from manufacturer's standard colors.

D. Color Anodic Finish:

1. Color: Light bronze.
2. Color: Medium bronze.
3. Color: Dark bronze.
4. Color: Black.

E. AMFXX

1. Manufacturer:
2. Product Series:
3. Color Name and Number

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 084110
INTERIOR STOREFRONT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Interior storefront (interior glazed aluminum partitions) and supplementary items necessary for installation.

B. Related Section:

1. Division 08 Section "Interior Aluminum Frames" for aluminum frames used for doors and glazing installed in gypsum board partitions.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

1.4 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. EFCO Corporation, a Pella Company.
2. Kawneer North America; an Alcoa Company.
3. Oldcastle BuildingEnvelope.
4. YKK AP America Inc.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Kawneer North America; an Alcoa Company; Trifab VG 450, 1-3/4 in (44 mm) face, 4-1/2 in (113 mm) depth, glass in center.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated, including but not limited to loads established by authorities having jurisdiction and applicable building codes.

1. Uniform Lateral Load: 5 lbs per sq. ft. (25 kg/square m) based on testing Manufacturer standard system in assemblies similar to those indicated for this Project.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Edge deflection of individual glazing lites limited to 1/175 for glass edge lengths up to 13 feet 6 inches (4.1 m), and limited to 1/240 plus 1/4 inch (6.35 mm) for glass edge lengths greater than 13 feet 6 inches (4.1 m).

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 / B 209M.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / B 221M.
3. Extruded Structural Pipe and Tubes: ASTM B 429 / B 429M.
4. Structural Profiles: ASTM B 308 / B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Internal Steel Reinforcement for High Spans: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

C. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 GLAZING

A. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section "Glazing".

2.6 FABRICATION

A. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

B. Framing Members: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
6. Fabricate for flush glazing (without projecting stops).

C. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. Provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish Selections: As scheduled or indicated in Design Selections.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2604 or 2605 and containing not less than 50 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2604 or 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

C. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

D. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 EXAMINATION

A. Examine substrate surfaces to receive glazed aluminum partitions and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory

conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.5 INSTALLATION OF GLAZED ALUMINUM PARTITIONS

A. General:

1. Do not install damaged components.
2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure non-movement joints.
4. Install anchors with separators and isolators to prevent impediments to movement of joints.
5. Do not cut, trim, weld or braze component parts during erection, in any manner which would damage finish, decrease strength or result in visual imperfection or failure in performance of construction.
6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints within glazed aluminum framing system according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

B. Install components plumb and true in alignment with established lines and grades, and without warp or rack. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers.

C. Install glazing as specified in Division 08 Section "Glazing".

3.6 ERECTION TOLERANCES

A. Erection Tolerances: Install to comply with the following non-accumulating maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 in (3 mm) in 12 ft (3 mm in 3.7 m); 1/4 in (6 mm) over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 in (1.5 mm).
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 in (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 in (3 mm).

3.7 ARCHITECTURAL METAL FINISH SCHEDULE

A. Color and Gloss:

B. Color and Gloss: Match sample accepted by Architect.

C. Color Anodic Finish:

1. Color: Light bronze.
2. Color: Medium bronze.
3. Color: Dark bronze.
4. Color: Black.

D. AMFXX

1. Manufacturer:
2. Product Series:

3. Color Name and Number

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 084113
INTERIOR FIRE-RATED GLAZING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fire-rated framing system, glazing and supplementary items necessary for installation.:

1. Fire-protection-rated glazing.
2. Fire-resistance-rated glazing.

1.2 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1. Metal Finishes: 6-inch- (150-mm-) long sections of fittings, and other items.
2. Glass Samples: For each type of glass product; 12 inches (300 mm) square, showing exposed-edge finish.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

C. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

B. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during remainder of construction period.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion,

B. Installer Warranty: Furnish installer written workmanship warranty signed by an authorized representative using installer standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. “Defects” is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. TGP Architectural.
2. McCrory Glass / Forster Steel Framing.
3. SAFTIFIRST Safety and Fire Technology Inc.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: TGP Architectural; Fireframes Aluminum Series Frames and Designer Series Doors.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials

B. Source Limitations for Glass and Glazing: For each glass type, product and installation method, obtain from single source from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems to withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

B. Accessibility Requirements: Comply with applicable provisions in the ADA Accessibility Standards, ABA Accessibility Standards and the Building Code.

C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:

1. Live Load Deflection: Accommodate differential vertical deflection of floors.

D. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label indicates manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

1. Submit label location and size for Owner approval prior to fabrication. Glass having labels in locations not pre-approved shall be removed and replaced with glass having labels in the correct location at no cost to Owner.

2.5 GLASS PRODUCTS

A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Ultraclear Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear), with visible light transmission not less than 91 percent.

C. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

E. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

2.6 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and complies with NFPA 80.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label indicates manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F (250 deg C) temperature-rise limitation; and fire-resistance rating in minutes.

C. Fire-Protection-Rated Laminated Glass with Intumescent Interlayer: Laminated glass made from multiple plies of uncoated, float glass; with intumescent interlayers; complying with 16 CFR 1201, Category II.

1. Technical Glass Products; Pilkington Pyrostop 45, Fire Rated, Impact Safety Rated Glass.

D. Fire-Protection-Rated Insulated Glass Units: Typical 1-inch thickness, incorporating glass products recommended by manufacturer for required ratings. Impact safety-rated complies with ANSI Z97.1 and 16 CFR 1201 (Categories I and II).

1. Basis of Design: Technical Glass Products; FireLite IGU.

2.7 FIRE-RESISTANCE-RATED GLAZING

A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing in accordance with ASTM E119 or UL 263.

1. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings.

B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label indicates manufacturer's name, test standard, that glazing is approved for use in doors and walls, and fire-resistance rating in minutes.

C. Fire-Resistance-Rated Framing and Doors: Fire-resistance-rated glazing with 60-, 90-, and 120-minute ratings requires framing and doors from glass supplier, tested as an assembly complying with ASTM E119 or UL 263.

D. Fire-Resistance-Rated Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, clear or ultraclear float glass; with intumescent interlayers; complying with 16 CFR 1201, Category II.

1. Basis of Design: Technical Glass Products; Pilkington Pyrostop, Fire Rated, Impact Safety Rated Glass.

2.8 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800

D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

C. Perimeter Insulation for Fire-Resistance-Rated Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.10 ENTRANCE DOOR HARDWARE

A. General: Entrance door hardware units in sizes, quantities, and types recommended by manufacturer for all-glass entrance systems indicated. For exposed parts, match metal and finish of fittings.

2.11 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.12 ALUMINUM FINISHES

A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.

1. Finish Selections: As scheduled or indicated in Design Selections.

B. Baked Enamel Finish or Powder-Coat Finish: Provide baked enamel or powder coated finish at interior surfaces complying with AAMA 2604 except with a minimum dry film thickness of 1.2 mils (0.03 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

C. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

D. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors

which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

C. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.4 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites with proper orientation so that coatings face fire side or protected side in accordance with manufacturer recommendation.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.5 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.6 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

D. Install gaskets so they protrude past face of glazing stops.

3.7 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial washaway from glass.

3.8 INSTALLATION OF ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.

3.9 ERECTION TOLERANCES

A. Install entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:
   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
   c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.10 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 084127
EXTERIOR ALL-GLASS STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: All-glass storefront systems and supplementary items necessary for exterior installations.

1.2 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Shop drawings shall contain seal of a professional engineer currently registered in licensing jurisdiction of the project and a written statement that the glazing system conforms to project requirements, applicable codes, and specified conditions.
2. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.

C. Samples for Verification Purposes: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Finishes: 6 in (150 mm) long sections of fittings, accessory fittings, and other items.
2. Glass: 6 in (150 mm) square, showing exposed-edge finish.

1.4 INFORMATIONAL SUBMITTALS

A. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

C. Field Quality Control Reports: Written report of testing and inspection required by “ÓField Quality Control”.

D. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
   a. Architect.
   b. Contractor, including superintendent.
   c. Installer, including project manager and supervisor.
   d. If requested, Manufacturer's qualified technical representative.
   e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review inspection and testing requirements.
   e. Review environmental conditions and procedures for coping with unfavorable conditions.
   f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

A. Manufacturer’s Warranty: Furnish manufacturer’s written material and labor warranty signed by an authorized representative using manufacturer’s standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 2 years from date of Substantial Completion, except as follows:

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit

as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. ACI Distribution; a division of Vitro America, Inc.
2. Alpha Door & Rail, Inc.
3. Arch Aluminum & Glass Co., Inc.
4. Blumcraft of Pittsburgh.
5. C.R. Laurence Co., Inc.
6. Ellison Bronze.
7. Virginia Glass Products Corporation; a subsidiary of Virginia Mirror Company.
8. Vistawall Architectural Products; an Oldcastle Glass Company.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.

B. Design Loads: Engineer to withstand design loads including, but not limited to, gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable local building codes, and as indicated.

1. Structural Movement: Engineer to withstand movements of structure including, but not limited to, drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads.

a. System shall accommodate plus or minus 3/8 in (10 mm) differential vertical deflection of floors.

C. Deflection Limits: At design wind pressure, as follows:

1. Deflection Normal to Glazing Plane: Limited to 1/175 of clear span or 3/4 in (19 mm), whichever is less.

D. Windborne-Debris-Impact-Resistance Performance: Comply with impact resistance testing requirements for Wind Zone.

E. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

F. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 MATERIALS

A. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section Glazing.

1. Glass Types: As scheduled or indicated in Design Selections.
2. Exposed Edges: Machine ground and flat polished.
3. Butt Edges: Flat ground.
4. Corner Edges: Lap-joint corners with exposed edges polished.

B. Aluminum Extrusions: ASTM B 221 / B 221M, with strength and durability characteristics of not less than Alloy 6063-T5.

C. Bronze Cladding: ASTM B 36, alloy UNS No. C28000 (muntz metal, 60 percent copper); minimum 0.04 in (1.0 mm) thick.

D. Brass Cladding: ASTM B 36, alloy UNS No. C26000 (cartridge brass, 70 percent copper); minimum 0.04 in (1.0 mm) thick.

E. Stainless Steel Cladding: ASTM A 240 / A 240M, austenitic stainless steel, Type 316; minimum 0.04 in (1.0 mm) thick.

2.5 METAL COMPONENTS

A. Storefront Configuration:

1. Recessed glazing channel at top and bottom.
2. Recessed glazing channel at top and continuous rail fitting at bottom.
3. Continuous rail fitting at top and bottom.
4. As indicated on drawings.

B. Fitting Material:

1. Aluminum.
2. Bronze-clad aluminum.
3. Brass-clad aluminum.
4. Stainless-steel-clad aluminum.

C. Rail Fittings: Match patch-fitting metal and finish.

1. Height: 3-1/2 in (87 mm).
2. Profile: Square.

D. Anchors and Fastenings: Concealed.

2.6 BUTT-GLAZING SEALANTS

A. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses NT, G, and A.

2.7 FABRICATION

A. Provide holes and cutouts in glass to receive fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.

1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of storefront.

B. Factory-assemble components and factory install fittings to greatest extent possible.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: As scheduled or as indicated in Design Selections.

2.10 COPPER-ALLOY FINISHES

A. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products".

B. Buffed Finish, Lacquered: M21-06x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).

C. Hand-Rubbed Finish, Lacquered: M31-M34-06x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).

D. Medium-Satin Finish, Lacquered: M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below).

E. Statuary Conversion Coating over Satin Finish: M31-C55-06x (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide; Coating: clear, organic, air drying, as specified below), with color matching Architect's sample.

F. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

2.11 STAINLESS STEEL FINISHES

A. General: Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Directional Satin Finish: No. 4.

C. Reflective, Directional Polish: No. 7.

D. Mirrorlike Reflective, Nondirectional Polish: No. 8.

E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF ALL-GLASS STOREFRONTS

A. Install all-glass systems and associated components according to manufacturer's written instructions.

B. Set units level, plumb, and true to line, with uniform joints.

C. Maintain uniform clearances between adjacent components.

D. Install joint sealants as specified in Division 07 Section "Joint Sealants”.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.6 ADJUSTING

A. Remove excess sealant and glazing compounds and dirt from surfaces.

3.7 ARCHITECTURAL METAL FINISH SCHEDULE

A. Color Anodic Finish:

1. Color: Light bronze.
2. Color: Medium bronze.
3. Color: Dark bronze.
4. Color: Black.

B. Basis of Design: AMFXX

1. Manufacturer:
2. Product Series:
3. Color Name and Number:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 084128
INTERIOR ALL-GLASS ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: All-glass entrances and supplementary items necessary for interior installation for the following:

1. Swinging all-glass entrance doors.
2. Sliding all-glass entrance doors.
3. All-glass storefronts.

1.2 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. All-Glass Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of all-glass entrance door hardware, as well as procedures and diagrams. Coordinate final door hardware schedule with doors and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

D. Samples for Verification Purposes: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Finishes: 6 in (150 mm) long sections of patch and rail fittings, accessory fittings, and other items.
2. Glass: 6 in (150 mm) square, showing exposed-edge finish.
3. Door Hardware: For exposed door hardware of each type, in specified finish, full size.

E. Fabrication Samples: Of continuous rail fitting at bottom of all-glass entrances, made from 12 in (300 mm) lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Glazing.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Manufacturer’s Warranty: Furnish manufacturer’s written material and labor warranty signed by an authorized representative using manufacturer’s standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. “Defects” is defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Failure of operating components.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 2 years from date of Substantial Completion, except as follows:

a. Concealed Floor Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures"

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. ACI Distribution; a division of Vitro America, Inc.
2. Alpha Door & Rail, Inc.
3. Arch Aluminum & Glass Co., Inc.
4. Blumcraft of Pittsburgh.
5. C.R. Laurence Co., Inc.
6. Ellison Bronze.
7. Virginia Glass Products Corporation; a subsidiary of Virginia Mirror Company.
8. Vistawall Architectural Products; an Oldcastle Glass Company.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified for this Project, as determined by testing manufacturer's standard automatic door entrance systems, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Differential Glass Deflection: Where interior glazing is installed adjacent to a walking surface, the differential deflection of two adjacent unsupported edges shall not be greater than the thickness of the panels when a force of 50 lb/lf (730 N/m) is applied horizontally to one panel at any point up to 42 in (1050 mm) above the walking surface.

2.4 MATERIALS

A. Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials. Comply with Division 08 Section "Glazing".

1. Class 1: Clear monolithic.

a. Minimum Thickness:

1) Opening Heights less than 10 ft (3 m): 5/8 in (15 mm).
2) Opening Heights of 10 ft (3 m) to 12 ft (3.6 m): 3/4 in (19 mm).
3) Consult glass standards for heights above 12 ft (3.6 m).

2. Exposed Edges: Machine ground and flat polished.
3. Butt Edges: Flat ground.
4. Corner Edges: Lap-joint corners with exposed edges polished.

B. Aluminum Extrusions: ASTM B 221 / B 221M, with strength and durability characteristics of not less than Alloy 6063-T5.

C. Bronze Cladding: ASTM B 36, alloy UNS No. C28000 (muntz metal, 60 percent copper); minimum 0.04 in (1.0 mm) thick.

D. Brass Cladding: ASTM B 36, alloy UNS No. C26000 (cartridge brass, 70 percent copper); minimum 0.04 in (1.0 mm) thick.

E. Stainless Steel Cladding: ASTM A 240 / A 240M, austenitic stainless steel, Type 316; minimum 0.04 in (1.0 mm) thick.

2.5 METAL COMPONENTS

A. Swinging Door Fitting Configuration:

1. Continuous rail fitting at top and bottom.
2. Patch fittings at head and sill on pivot side only.
3. Patch fittings at head and sill on pivot side, and for lock at sill of swing side.
4. Patch fitting at top and continuous rail fitting at bottom.
5. As indicated on drawings.

B. Sliding Door Configuration:

1. Continuous rail fitting at top and bottom.
2. As indicated on drawings.

C. Storefront Configuration:

1. Recessed glazing channel at top and bottom.
2. Recessed glazing channel at top and continuous rail fitting at bottom.
3. Continuous rail fitting at top and bottom.
4. As indicated on drawings.

D. Fitting Material:

1. Aluminum.
2. Bronze-clad aluminum.
3. Brass-clad aluminum.
4. Stainless-steel-clad aluminum.

E. Rail Fittings: Match fitting metal and finish.

1. Height:

a. Continuous Top Rail: 3-1/2 in (87 mm).
b. Continuous Bottom Rail: 10 in (250 mm).
c. Continuous Bottom Rail: 3-1/2 in (87 mm), with the leading edge tapered at no more than 60 degrees from the horizontal.

2. Profile: Square.
3. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.

F. Accessory Fittings: Glass-support-fin brackets; match fitting metal and finish.

G. Anchors and Fastenings: Concealed.

H. Integral Door Hardware: Manufacturers heavy duty complete concealed floor closers and top pivots assembly, overhead doorstop, and center-housing lock. Match patch-fitting metal and finish for exposed hardware.

I. Accessory Door Hardware: As specified in Division 08 Section "Door Hardware".

2.6 BUTT-GLAZING SEALANTS

A. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses NT, G, and A.

2.7 FABRICATION

A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.

1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.

B. Factory-assemble components and factory install integral hardware and fittings to greatest extent possible.

C. All patch fittings on the push side of the door, located within 10 in (255mm) of the floor, measured vertically, shall be fabricated or installed with tapered edges at no less than 60 degrees.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

C. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

1. Color: As scheduled or as indicated in Design Selections.

2.10 COPPER-ALLOY FINISHES

A. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products".

B. Buffed Finish, Lacquered: M21-06x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).

C. Hand-Rubbed Finish, Lacquered: M31-M34-06x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).

D. Medium-Satin Finish, Lacquered: M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below).

E. Statuary Conversion Coating over Satin Finish: M31-C55-06x (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide; Coating: clear, organic, air drying, as specified below), with color matching Architect's sample.

F. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

2.11 STAINLESS STEEL FINISHES

A. General: Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Directional Satin Finish: No. 4.

C. Reflective, Directional Polish: No. 7.

D. Mirrorlike Reflective, Nondirectional Polish: No. 8.

E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF ALL-GLASS ENTRANCES

A. Install all-glass systems and associated components according to manufacturer's written instructions.

B. Set units level, plumb, and true to line, with uniform joints.

C. Maintain uniform clearances between adjacent components.

D. Lubricate hardware and other moving parts according to manufacturer's written instructions.

E. Set, seal, and grout floor closer cases as required too suit hardware and substrate indicated.

F. Install joint sealants as specified in Division 07 Section "Joint Sealants”.

G. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 in (75 mm) from the latch, measured to the leading door edge.

B. Remove excess sealant and glazing compounds and dirt from surfaces.

3.6 ARCHITECTURAL METAL FINISH SCHEDULE

A. Color Anodic Finish:

1. Color: Light bronze.
2. Color: Medium bronze.
3. Color: Dark bronze.
4. Color: Black.

B. Basis of Design: AMFXX

1. Manufacturer:
2. Product Series:
3. Color Name and Number:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 084243
MEDICAL SPECIALTY SLIDING ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Interior, manually operated, medical specialty sliding entrance door assemblies with emergency breakaway capabilities and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.3 INFORMATIONAL SUBMITTALS

A. Warranties:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate sizes and locations of recesses in concrete floors for recessed sliding tracks. Concrete, reinforcement, and formwork requirements are specified in Division 03 Sections.

C. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing sliding entrances.

1.7 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product.

1. "Defects" are defined to include but not limited to deterioration or failure to perform as required and include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Faulty operation of hardware.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into Work include but are not limited to those listed.

C. Manufacturers:
   1. Besam Entrance Solutions; an ASSA ABLOY Group Co.
   2. Horton Automatics; a division of Overhead Door Corp.
   3. Nabco Entrances, Inc.
   4. Record-USA

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221(ASTM B 221M).
   2. Sheet and Plate: ASTM B 209(ASTM B 209M).

B. Sealants and Joint Fillers: As specified in Division 07 Section "Joint Sealants."

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 MEDICAL SPECIALTY SLIDING ENTRANCE ASSEMBLIES

A. General: Provide manufacturer's standard sliding entrances including door leaves, sidelites, framing, headers, carrier assemblies, roller tracks, and accessories required for a complete installation.

B. Opening-Force Requirement, Sliding: Not more than 5 lbf (22.2 N) to fully open door.

C. Medical Specialty Sliding Entrance:
   1. Configuration: Panel configuration as indicated on drawings with breakaway capability
   2. Floor Track Configuration: No track across sliding-door opening and at sidelites (trackless).

2.5 COMPONENTS

A. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 in (3.2 mm) thick and reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 4-1/2 in (45 by 115 mm).
2. Extruded Glazing Stops and Applied Trim: Minimum 0.062 in (1.6 mm) wall thickness.

B. Stile and Rail Doors: Manufacturer's standard 1-3/4 in (45 mm) thick glazed doors with minimum 0.125 in (3.2 mm) thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie rods that span full length of top and bottom rails.

1. Glazing Stops and Gaskets: Manufacturer’s standard snap-on, extruded-aluminum stops and preformed gaskets for glazing indicated.
2. Stile Design: Medium stile; 3-1/2 in (90 mm) nominal width.
3. Rail Design: 3-1/2 in (90 mm) nominal height.
4. Muntin Bars: Horizontal tubular rail member for each door; match stile design.

C. Sidelites: Manufacturer's standard 1-3/4 in (45 mm) deep sidelites with minimum 0.125 in (3.2 mm) thick, extruded-aluminum tubular stile and rail members matching door design and finish.

1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
2. Muntin Bars: Horizontal tubular rail member for each sidelite; match stile design.

D. Glazing: As specified in Division 08 Section "Glazing."

E. Integral Louver Blinds Unit: 1 in (25 mm) thick insulated glass unit consisting of two 1/8 in (3 mm) tempered glass lites sandwiched with white mini-blinds in air space; blinds to be tilted via external ADA-compliant device both sides of door (unless indicated otherwise) having a force to tilt blinds of less than 2.25 lbf (10 N). Provide integral louver blinds manufacturer's standard framing kit for a complete installation.

1. Manufacturer and Product: Kyler Industries; Screenline series, Model SL20AA (Tilt Only, Dual Operator).

F. Headers: Fabricated from minimum 0.125 in (3.2 mm) thick extruded aluminum, and extending full width of sliding entrance units to conceal carrier assemblies and roller tracks. Provide hinged or removable access panels for service and adjustment. Secure panels to prevent unauthorized access.

1. Capacity: Capable of supporting doors up to 100 lb (45 kg) per leaf over spans up to 14 ft (4.3 m) without intermediate supports.
2. Provide sag rods for spans exceeding 14 ft (4.3 m).

G. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track or of ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly. Provide minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.

H. Concealed Bottom Rollers: Manufacturer's standard.

I. Brackets and Reinforcements: Manufacturer's standard, high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

J. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.6 HARDWARE

A. General: Provide units in sizes and types recommended by sliding entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.

B. Positive Latching: Doors shall have automatic positive latching with lever handle operation.

C. Breakaway Hardware: Provide release hardware that allows indicated panels to swing out as indicated on the Drawings to full 90 degrees from sliding mode.

1. Maximum Force to Open Panel: 25 lbf (111 N).
2. Release Position: At any point in sliding door travel.

D. Limit Arm: Provide to control doors in the swing mode.

E. Manual Flush Bolts: BHMA A156.16, Grade 1, edge mortised, lever-extension type; located at bottom of each swing-out sidelite.

F. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
2. Sliding Type: AAMA 701, wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

G. Weather Sweeps: Manufacturer's standard, nylon brush sweep mounted to underside of door bottom.

2.7 FABRICATION

A. General: Factory-fabricate sliding entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

1. Fabricate aluminum components before finishing.
2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.

a. Where fasteners are subject to loosening or turning out from structural movements or vibration, use self-locking devices.
b. Reinforce members as required to receive fastener threads.

4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

B. Framing: Provide sliding entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.

1. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
3. Form profiles that are straight and free of defects or deformations.
4. Provide components with concealed fasteners and anchor and connection devices.
5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.

6. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

E. Hardware: Factory-install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.

1. Provide sliding weather stripping, mortised into door, at perimeter of sliding doors and breakaway sidelites.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Apply anodic finishes to formed-metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Approved submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.

B. Install sliding entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.

C. Glazing: Install glazing as specified in Division 08 Section "Glazing."

D. Sealants: Comply with requirements in Division 07 Section "Joint Sealants" for installing sealants, fillers, and gaskets.

1. Set framing members, floor tracks, and flashings in full sealant bed.
2. Seal perimeter of framing members with sealant.

3.5 ADJUSTING

A. Adjust operating hardware and moving parts for smooth and safe operation; lubricate as recommended by manufacturer.

B. Adjust force to open swing panels.

3.6 CLEANING AND PROTECTION

A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

B. Comply with requirements in Division 08 Section "Glazing" for cleaning and protecting glass.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 084400
GLAZED ALUMINUM FRAMING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Glazed aluminum framing systems and supplementary items necessary for installation.

1. Field fabricated stick system, aluminum curtain wall and window wall systems.
2. Field fabricated stick system, custom aluminum curtain wall and window wall systems.
3. Factory fabricated unitized system, aluminum curtain wall and window wall systems.
4. Factory fabricated unitized system, custom aluminum curtain wall and window wall systems.
5. Sloped glazing systems.
6. Aluminum storefront systems.
7. Operable window vent systems.

B. Related Requirements:

1. Refer to Division 01 Section Laboratory Performance Mockup Testing for Building Enclosure System.
2. Refer to Division 01 Section Field Test for Air and Water Leakage.
3. Refer to Division 01 Building Enclosure Commissioning Plan for Field Observations and Performance Testing.

C. Proposal Drawings: Submit with bid or proposal, preliminary product data and shop drawings for products and systems, including the interface with adjacent construction and Work to be performed by other contractors. Proposal drawings shall clearly indicate quality and scope of proposed systems.

1. Quality Assurance/Quality Control Plan: For fabrication procedures and erection including, but not limited to, alignment of adjacent curtain wall elements, structural frame tolerances, curtain wall tolerances and embed layout.

1.2 DEFINITIONS

A. Water Leakage: Uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces, or water that is not contained and drained to the exterior, or water that may damage adjacent materials or finishes. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

1. Uncontrolled: Infiltrated water that is not captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that wets perimeter containment system, wall insulation or exposed interior surfaces.
2. Controlled: Infiltrated water that is captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that does not wet perimeter containment system, wall insulation or exposed interior surfaces.

B. Sloped Glazing: Glass and framing assembly sloped more than 15 degrees from the vertical plane forming a roof. Sloped glazing serves as the roof for an area of the building.

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:
    a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
    b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.
    1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
    1. Prepared by manufacturer, not installer.
        a. Shop drawings not prepared by manufacturer shall include manufacturer's written approval on shop drawings.
        b. Shop drawings shall contain seal of a structural engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
    2. Include typical unit elevations at 1/2 in (12 mm) scale and details at full scale.
    3. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
    4. Indicate where and how the system deviates from Contract Documents.
    5. Provide material properties and other information needed for structural analysis including computations, prepared, signed and sealed by a structural engineer licensed to practice in the jurisdiction where the project is located.

a. Calculations shall include but not limited to the following:

1) Section properties for framing members.
2) Analysis of framing members.
3) Analysis of anchors and embedded anchors in concrete structure.
4) Analysis of stress in structural silicone.
5) Analysis of glass thicknesses and strength.

6. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.
7. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
8. Include full-size isometric details of typical and special conditions within the system, showing the following:

a. Mullion details, including reinforcement and stiffeners.
b. Joinery details, including concealed welds.
c. Anchorage.
d. Expansion provisions.
e. Glazing details.
f. Flashing and drainage details.
g. Weather-stripping and weather seals within curtain wall framing.
h. Thermally improved details.
i. Perimeter weather seals and structural seals.
j. Interface with other building construction.
k. Identification and detail of perimeter fire containment system.
l. Window cleaning provisions.
m. De-glazing and re-glazing procedures.

1) Unless indicated otherwise, framing and glass shall be designed to be re-glazed from the exterior using original glass size and gaskets without modification to framing. Comply with manufacturer recommended re-glazing procedure.

n. Attachment details, including thickness of curtain wall components, designed to receive lightning protection system.

9. Submit insert/embed drawings including layout and enlarged details. Include detail and engineering calculations for field modifications due to location and/or omitted inserts/embeds.
10. Window System Operators for Operable Window Vent Systems: Show locations, mounting, and details for installing operator components and controls.
11. Include laboratory performance mock-up shop drawings showing details of fabrication and installation.

a. Resubmit Shop Drawings with changes made to details of glazed aluminum framing systems, to successfully complete preconstruction testing.

C. Samples for Verification: For each type of exposed finish required, prepared on samples of size indicated below.

1. Exposed Finishes: 12 in (300 mm) long sections of extrusions or formed shapes, 6 in (150 mm) squares of sheet or plate, each finish type and color.
2. Sealants and Gaskets: 12 in (304 mm) minimum length for sealant or gasket glazed joint, each type and color.

D. Fabrication Samples: Of each vertical-to-horizontal intersection of assemblies, made from 12 in (300 mm) lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing, including sealants and gaskets, each type and color.
5. Flashing and drainage.
6. Include fabrication sample of any unusual condition.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Energy Performance Certificates: For glazed aluminum framing systems, accessories, and components.

1. Basis for Certification: Certified by manufacturer for energy performance ratings as determined in accordance with NFRC.

D. U-Value and Condensation Evaluation: Determine wall system U-Value and provide condensation evaluation using NFRC approved version of Lawrence Berkeley National Laboratory THERM software for simulations. Submit isothermal condensation results, including isothermal graphics, for temperature limits of wall system components.

E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Anchors and Fasteners: Tested and qualified for use in accordance with ICC-ES or other product approval acceptable to authorities having jurisdiction.
2. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

F. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

G. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1. Structural-Sealant Glazing: For structural-sealant glazing, include ASTM C 1401 recommendations for post-installation-phase, quality-control program.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar in scope to this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope to this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope to this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

a. Subcontractor Responsibility: Work included in this Technical Section shall be performed by a qualified single subcontractor solely responsible for engineering, fabrication and installation of the Work.

C. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

D. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements when indicated.

E. Structural-Sealant Glazing: Comply with ASTM C 1401 "Guide for Structural Sealant Glazing" for design and installation of glazed aluminum wall systems utilizing structural-sealant glazing.

1. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.
2. Comply with ASTM C 1135 Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruct 01 Section Laboratory Performance Mockup Testing for Building Enclosure System.

B. Preconstruction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will be in contact with sealants and for each condition.

1. Test a minimum five production-run samples each of metal, glazing, and other material.

a. Include all adjacent materials with watertight seals to curtain wall systems.

2. Prepare samples using techniques and primers required for installed assemblies.
3. Perform tests under environmental conditions that duplicate those under which assemblies will be installed.
4. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

1.9 MOCKUPS

A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.10 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.
f. Owner's Building Enclosure Commissioning provider.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.

1) Review construction tolerances for structural frame and construction surveying requirements.

b. Review Contract Document Requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Protect materials according to manufacturer's written instructions.

B. Prevent damage to framing, glass and glazing materials from abrasion, soiling, contamination, wetting or condensation, temperature changes, direct exposure to sun, or other causes.

1. Use crating, stacking and storage procedures that prevent damage to finishes and gaskets.

1.12 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.13 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.14 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Thermal stresses transferring to building structure.
c. Glass breakage.
d. Noise or vibration created by wind and thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Deterioration of metals and other materials beyond normal weathering.
g. Water penetration through fixed glazing and framing areas.
h. Air infiltration exceeding performance requirements.
i. Adhesive or cohesive sealant failures.
j. Failure of operating components.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion

B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

C. Factory Applied Finish Warranty for Fluoropolymer Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Coverage includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

D. Factory Applied Finish Warranty for Baked Enamel Interior Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Coverage includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 10 years from date of Substantial Completion.

E. Factory Applied Finish Warranty for Anodic Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Baker Metal Products Inc.
2. Bruce Wall Systems Corporation.
3. C.R. Laurence - US Aluminum.
4. Crown Corr Inc.
5. EFCO Corporation, a Pella Company.
6. Harmon Inc.
7. Kawneer North America; an Alcoa Company.
8. Oldcastle BuildingEnvelope.
9. YKK AP America Inc.

D. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect.

E. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Curtain Wall System; Captured Glazing:

a. Basis of Design: Kawneer 1600 Wall.

2. Curtain Wall System; Captured Glazing, Two Sided:

a. Basis of Design: Kawneer 1600 Wall.

3. Curtain Wall System:

a. Basis of Design: Kawneer 1600UT Wall.

4. Curtain Wall System; Structural Silicone Glazing, Four Sided - Unitized System:

a. Basis of Design: Kawneer PG 2500 Wall.

5. Curtain Wall System; Toggle Glazing, Four Sided:

a. Basis of Design: Kawneer Clearwall.

6. Window Wall System; Captured Glazing:

a. Basis of Design: Kawneer 1600.

7. Window Wall System; Captured Glazing, Two Sided:

a. Basis of Design: Kawneer 1600.

8. Window Wall System:

a. Basis of Design: Kawneer 1600UT Wall.

9. Sloped Glazing System:

a. Basis of Design: Kawneer 1600 SG.

10. Storefront System:

a. Basis of Design: Kawneer VG 451T with High Performance Sill Flashing.

11. Operable Window Vent System:

a. Basis of Design: Kawneer GLASSvent.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Failure includes but is not limited to the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Thermal stresses transferring to building structure.
c. Glass breakage.
d. Noise or vibration created by wind and thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Deterioration of metals and other materials beyond normal weathering.
g. Water penetration through fixed glazing and framing areas.
h. Air infiltration exceeding performance requirements.
i. Failure of operating units

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:

1. Live Load Deflection: Accommodate differential vertical deflection of floors:

a. Deflection: As indicated on Drawings.
b. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement and 1.5 times the design displacement.

2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:

a. Design Displacement: As indicated on Drawings.
b. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement and 1.5 times the design displacement.
c. Connections shall permit movement in the plane of the panel for inter-story drift and shall be properly designed sliding type connections using slotted or over-sized holes, or connections permitting movement by bending of steel or other connections providing equivalent sliding and ductile capacity.

1) Connector bodies shall have sufficient ductility and rotational capacity to prevent fracture of concrete or brittle failure near welds.
2) Fasteners embedded in concrete shall be attached to reinforcing steel or otherwise terminated to effectively transfer forces to the reinforcing steel in accordance with applicable Building Code requirements.

D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

E. Deflection of Framing Members: At design wind load in accordance with the Building Code.

1. Deflection Normal to Wall Plane: Edge deflection of individual glazing lites limited to 1/175 for glass edge lengths up to 13 feet 6 inches (4.1 m), and limited to 1/240 plus 1/4 inch (6.35 mm) for glass edge lengths greater than 13 feet 6 inches (4.1 m) and less than 40 feet (12 m), when designed in accordance with AAMA TIR A11-15 and tested in accordance with ASTM E 330/E330M-14.

a. Exceptions:

1) Where a sealant joint occurs between a framing member and a relatively stiff building element, framing member deflection not more than 1/2 of nominal joint width, or less if required by sealant manufacturer.

b. Span is defined as the distance between anchor center line.

2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces

edge clearance between framing members and glazing or other fixed components to less than 1/8 in (3 mm).

a. Operable Units (Doors or Windows): Provide a minimum 1/16 in (1.6 mm) clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 2L/175 where L is the cantilever length.

4. Deflection of Framing System Interior Trim: Center deflection of interior trim shall not exceed 1/4 in (6 mm) when subjected to a 250 pound (113 Kg) vertical concentrated load. No permanent deformation allowed when load is removed.

a. Window sill extension trim.
b. Slab edge covers.

F. Flexural Members for Sloped Glazing: Design for lateral bracing of compression flanges by cross members with minimum depth equal to 50 percent of braced flexural member. Glazing does not provide lateral support.

G. Structural Test Performance: Test according to ASTM E 330/330M as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

H. Water Penetration under Static Pressure for Storefront System: Test in accordance with ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sf (480 Pa).

I. Water Penetration under Static Pressure for Curtain Wall and Window Wall Systems: Test in accordance with ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf (576 Pa).

J. Water Penetration under Dynamic Pressure for Curtain Wall and Window Wall Systems: Test in accordance with AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf (576 Pa).

K. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

1. Provide drainage to exterior of wall for water entering at joints or glazing reveals, condensation occurring within assemblies, secondary water from adjacent wall systems and similar conditions.

a. Provide internal gutters and weep system to collect and drain water leakage and condensation to the exterior.

1) Stick framed curtain wall systems and punched windows shall have an isolated gutter cavity at each glass perimeter such that leakage is confined to and weeped from the opening where leakage originated.
2) Unitized curtain walls shall have continuous spliced gutters at horizontal stack joints with sealed end caps at termination conditions.
3) Window wall shall have a continuous gutter and weep holes at the glass sill and a continuous gutter at the glass head that drains directly to exterior or directs leakage from spandrel above to the window sill.

b. Provide continuous subsill below windows with interlocking mullions.
c. Coordinate gutter and weep systems with drainage provisions with adjacent construction.
d. Coordinate connection of drainage members at columns, spandrel beams and other areas with limited access.
e. The use of carbon steel components for gutter and drainage assemblies is prohibited; provide stainless steel or aluminum components.

L. Energy Performance: Certified or labeled by manufacturer for energy performance ratings in accordance with NFRC.

1. Thermal Transmittance (U-Factor) - Fixed Vision Glazing and Framing Areas: U-factor as determined in accordance with NFRC 100.

a. Maximum U-Factor: As indicated on Drawings, comply with building energy performance model for this project.

2. Thermal Transmittance (U-Factor) - Fixed Spandrel Glazing, Metal Panels and Framing Areas: U-factor as determined in accordance with NFRC 100.

a. Maximum U-Factor: As indicated on Drawings, comply with building energy performance model for this project.

3. Solar Heat Gain Coefficient (SHGC) - Fixed Glazing and Framing Areas: Solar Heat Gain Coefficient as determined in accordance with NFRC 200.

a. Maximum SHGC: As indicated on Drawings, comply with building energy performance model for this project.

4. Air Leakage - Glazed Aluminum Wall and Storefront:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sf (0.30 L/s/sm) at a minimum static-air-pressure differential of 6.24 lbf/sf (300 Pa) when tested in accordance with ASTM E 283.

5. Condensation Resistance: Condensation resistance as determined in accordance with NFRC 500.

a. Fixed Glazing and Framing Areas: No condensation allowed under design conditions indicated.

M. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows:

1. Outdoor-Indoor Transmission: Minimum Class 34.

N. Building Maintenance Equipment: Engineer units supporting building maintenance equipment to resist pull-out and horizontal shear forces transmitted from equipment.

O. Windborne-Debris-Impact-Resistance Performance: Comply with missile impact and cyclic-pressure testing requirements for Wind Zone and facility type.

P. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance.

a. Fabrication, assembly and erection procedures shall take into consideration the ambient temperature range at the time of each operation.

Q. Structural-Sealant Joints:

1. Design reviewed and approved by structural-sealant manufacturer.

R. Structural-Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by glazed aluminum wall systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

S. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 / B 209M.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / B 221M.
3. Extruded Structural Pipe and Tubes: ASTM B 429 / B 429M.
4. Structural Profiles: ASTM B 308 / B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Internal Reinforcement: Shapes and sizes to suit installation meeting delegated engineered performance requirements, as indicated on Shop Drawings.

1. Structural Shapes, Plates, and Bars: ASTM A 36 / A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008 / A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011 / A 1011M.
4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

C. Bronze Cladding: ASTM B 36, alloy UNS No. C28000 (muntz metal, 60 percent copper); minimum 0.04 in (1.0 mm) thick.

D. Brass Cladding: ASTM B 36, alloy UNS No. C26000 (cartridge brass, 70 percent copper); minimum 0.04 in (1.0 mm) thick.

E. Stainless Steel Cladding: ASTM A 240 / A 240M, austenitic stainless steel, Type 316; minimum 0.04 in (1.0 mm) thick.

2.5 GLAZED ALUMINUM FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Structural Thermal Barriers: Provide thermally improved system in compliance with energy model and condensation performance requirements.
2. Field installation of four-sided structural glazing is not allowed.

a. Where shop installation of four-sided structural glazing is not feasible, submit proposed field installation locations to Architect for review.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

1. Shims:

a. Structural Connections: Series 300 Stainless Steel; ASTM A 36 or ASTM A 283 hot-dipped galvanized steel.

1) Dynamic Connections: Molybdenum disulfied filled nylon lubricated pads or washers.

b. Non-Structural Connections: U-shaped polystyrene.
c. Static Non-Load Transfer Connections: Korolath high-impact polystyrene pads.

2. For connections where shim height is greater than twice the bolt diameter, provide steel or aluminum shims.

a. Plastic shims are acceptable only in locations where shim height is less than twice the bolt diameter or fully bearing locations where there is no bending induced into the bolt anchor.

3. Mechanically restrain shims in dynamic connections to remain in place.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials. Domestically manufactured only.

1. Manufacturers and Products - Self Drilling, Self Tapping Screws:

a. Elco; Dril-Flex Structural Self-Drilling Screws.
b. Hilti; Kwik-Flex Structural Self-Drilling Screws.

2. Manufacturers and Products - Series 300 Stainless Steel Fasteners:

a. Elco; Bi-Flex 300 SS with Stalgard.
b. Elco; Alumi-Flex 302 SS with Stalgard.
c. SFS; Bi-Met 300.

3. Use Series 300 Stainless Steel fasteners for joining framing members and fasteners located in wet areas including fasteners penetrating the waterline and covered with sealant.
4. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
5. Reinforce members as required to receive fastener threads.
6. Use concealed fasteners; exposed fasteners are not allowed.

a. At locations where exposed fasteners are unavoidable and approved by Architect, use exposed fasteners with countersunk Phillips screw heads finished to match framing system.

7. Storefront: Furnish heavy duty aluminum sill pan with integral welded or fastened and structurally sealed end dams, typical.

D. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish and are compatible with adjoining materials and recommended by manufacturer. Domestically manufactured only.

1. Concrete and Masonry Inserts:

a. Product Quality Standards: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 / A 123M or ASTM A 153 / A 153M requirements.

b. Manufacturers:

1) Halfen.
2) Hilti.
3) Jordahl.
4) Unitstrut.

2. Post Installed Expansion Anchors:

a. Product Quality Standards: Tested and qualified for use in accordance with ACI 355.2, ACI 318 and ICC-ES AC193 for cracked, uncracked and seismic concrete recognition.

1) Material and Finish: Stainless steel ASTM F 593 Group 1 (Alloy 304/316), mechanically deposited ASTM B 695 or hot-dip zinc coating ASTM A 153 Class C. Thickness not less than 0.0002 inches.

b. Acceptable Manufacturers:

1) Dewalt.
2) Hilti.
3) ITW.
4) Simpson.

c. Not Acceptable: Chemical type anchors for overhead dead load connectors.

3. Threaded Concrete Anchors:

a. Product Quality Standards: Tested and qualified for use in accordance with ACI 355.2, ACI 318 and ICC-ES AC193 for cracked, uncracked and seismic concrete recognition.

1) Material and Finish: Carbon steel with corrosion resistant coating, not less than 1000 hours of salt spray resistance according to ASTM B 117; 300 Series Stainless Steel, non-magnetic.
2) Anchor Thickness: 3/8 inch minimum.

b. Acceptable Manufacturers:

1) Dewalt.
2) Elco.
3) Hilti.

c. Condition of Use: Shall not be used in overhead dead load connections supporting sustained load in tension.

E. Concealed Flashing: Dead-soft, 0.018 in (0.45 mm) thick stainless steel, ASTM A 240 / A 240M of type recommended by manufacturer.

F. Framing System Gaskets and Sealants: Refer to Division 08 Section “Glazing.

1. EPDM Gaskets: EPDM shall be isolated from direct contact with silicone; including but not limited to the secondary perimeter silicone seal of insulating glass units.

a. Provide silicone gaskets where gaskets are in contact with silicone sealant.

G. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.
2. At pressure caps, use ASTM A 193 / A 193M stainless-steel screws.

H. Glazed-In Aluminum-Faced Composite Wall Panels: Comply with Division 07 Section "Composite Metal Wall Panels."

I. Glazed-In Aluminum-Faced Insulated-Core Metal Panels: Comply with Division 07 Section "Insulated Metal Wall Panels."

J. Glazed-in Aluminum Plate Wall Panels: Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into profile for installation method indicated. Comply with Performance Requirements indicated in Division 07 Section "Composite Metal Wall Panels."

1. Material: Tension-leveled, smooth aluminum sheet, ASTM B 209 (ASTM B 209M), 0.125 in (3.18 mm) thick minimum.
2. Exterior Finish: Matching framing system.

2.6 SUN CONTROL DEVICES

A. Sunshades: Assemblies consisting of manufacturer's standard outrigger brackets, louvers, and fascia, designed for attachment to curtain wall with mechanical fasteners.

1. Basis of Design: As scheduled or indicated in Design Selections.

2.7 GLAZING

A. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section Glazing.

1. Glass Types: As scheduled or indicated in Design Selections.

B. Glazing Gaskets, Spacers, Setting Blocks, Sealant Backings, and Bond Breakers: Manufacturer's standard permanent, non-migrating types compatible with sealants and suitable for joint movement and assembly performance requirements. Comply with Division 08 Section "Glazing".

1. Silicone Sealant Compatibility: When in direct contact with silicone sealants, gaskets, spacers and setting blocks shall be heat cured silicone rubber based material which is chemically compatible and with sufficient hardness for the purpose intended and approved in writing by the glazing and curtain wall manufacturers.

C. Glazing Sealants: As recommended by manufacturer for joint type.

1. Structural-Glazing Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically

formulated and tested for use as structural-sealant and approved by structural-sealant manufacturer for use in glazed aluminum wall assembly indicated.

a. Minimum Tensile Strength: 100 psi (690 kPa).
b. Modulus of Elasticity: As required by structural-sealant-glazed aluminum wall system design to meet performance requirements.
c. Manufacturers and Products: Subject to compliance with requirements, provide one of the following:

1) Dow; DOWSIL 983 Structural Glazing Sealant.
2) GE Silicones; SSG4400 Ultraglaze Sealant.
3) Tremco Incorporated; Proglaze SSG.

d. Color: Black, unless otherwise scheduled or indicated in Design Selections Summary.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 50, neutral-curing silicone formulation compatible with system components with which it comes in contact, and recommended by weatherseal-sealant and curtain-wall manufacturers for this use.

a. Joint Movement Capability: Accommodates a 50 percent increase or decrease in joint width at time of application when measured according to ASTM C 719.
b. Color: Black, unless otherwise scheduled or indicated in Design Selections Summary.

3. Bond-Breaker Tape: Manufacturer's standard tetrafluoroethylene-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.8 BACK PAN

A. Back Pan: Provide factory-formed metal pans fabricated from single sheets of metal formed into profile for installation indicated. Maintain air space between pan and interior surface of glass. Provide continuous seal at pan joints and pan perimeter.

1. Material: Galvanized G90 steel, minimum 0.034 in (0.86 mm) thickness.
2. Curtain Wall Insulation: Minimum 2-inch thickness.
3. Accessories: Spacers, cold formed framing, furring, brackets, clips, hangers and components required for complete installation.

2.9 SHADOW BOX BACK PAN

A. Shadow Box Back Pan: Provide factory-formed metal pans fabricated from single sheets of metal formed into profile for installation indicated. Maintain air space between pan and interior surface of glass; ventilate air space when recommended by manufacturer. Provide continuous seal at pan joints and pan perimeter.

1. Material: Smooth aluminum sheet, ASTM B 209 (ASTM B 209M), 0.125 in (3.2 mm) thick.
2. Curtain Wall Insulation: Minimum 2-inch thickness.
3. Accessories: Spacers, cold formed framing, furring, brackets, clips, hangers and components required for complete installation
4. Finish: As scheduled or as indicated in Design Selections.

2.10 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of glazed aluminum framing systems, as specified in Division 07 Section "Joint Sealants".

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mils (0.762 mm) thickness per coat.

C. Perimeter Fire-Containment System for Curtain Wall Spandrel Conditions: Safing insulation and curtain wall insulation as specified in Division 07 Section "Fire-Resistive Joint Systems".

D. Thermal Insulating Materials: As specified in Division 07 Section Thermal Insulation.

E. Maintenance Equipment Anchors: As specified in Division 11 Section Building Maintenance Equipment.

F. Cleaning Agent and Cloth: As recommended by structural-sealant manufacturer.

G. Linings, Spacers and Sleeves: At dynamic or moving joints, provide type and materials recommended by manufacturer to provide a fully sealed penetration.

2.11 FABRICATION

A. Do not expose unfinished or cut edges to view.

B. Shop weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Welds shall be of adequate strength and durability, with jointing tight, flush, smooth and clean. Weld behind finished surfaces so as to cause no distortion and/or discoloration on the finished side. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

1. Field welding aluminum is not allowed.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that is sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing. Provide minimum clearances and depth of glazing packets as recommended by glass manufacturer for thickness and type of glass indicated.

a. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural-sealant cures.

6. Fasteners, anchors, and connection devices that are concealed from view.
7. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum framing systems to exterior.
8. Components curved to indicated radii.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. For Factory-Assembled and Glazed Frame Units:

1. Rigidly secure non-movement joints.
2. Seal joints watertight unless otherwise indicated.
3. Factory-install glazing to comply with requirements in Division 08 Section "Glazing".
4. Structural-Sealant Units: Prepare surfaces that will contact structural-sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Concealed members may be mill finish, providing that they cannot be seen through the glass, do not contact any structural silicone or are not continually exposed to water immersion.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

E. Selections: As scheduled or as indicated in Design Selections.

2.13 ALUMINUM FINISHES

A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.

B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

C. Baked Enamel Finish or Powder-Coat Finish at Interior Surfaces: At Contractor's option, provide baked enamel or powder coated finish at interior surfaces complying with AAMA 2604 except with a minimum dry film thickness of 1.2 mils (0.03 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Selection: Match exterior mullions unless indicated otherwise.

D. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

E. Clear Anodic Finish at Interior Surfaces: AA-M12C22A31, Class II, 0.010 mm or thicker.

F. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

G. Color Anodic Finish at Interior Surfaces: AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

2.14 COPPER-ALLOY FINISHES

A. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products".

B. Buffed Finish, Lacquered: M21-06x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).

C. Hand-Rubbed Finish, Lacquered: M31-M34-06x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).

D. Medium-Satin Finish, Lacquered: M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below).

E. Statuary Conversion Coating over Satin Finish: M31-C55-06x (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide; Coating: clear, organic, air drying, as specified below)[, with color matching Architect's sample].

F. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

2.15 STAINLESS STEEL FINISHES

A. General: Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Directional Satin Finish: No. 4.

C. Reflective, Directional Polish: No. 7.

D. Mirrorlike Reflective, Nondirectional Polish: No. 8.

E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.16 SOURCE QUALITY CONTROL FOR STRUCTURAL-SEALANT-GLAZED SYSTEMS

A. Structural-Sealant-Glazed Systems: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

1. Structural-sealant-glazed system will be considered defective if it does not pass tests and inspections.
2. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.

3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

1. Furnish inserts for setting in concrete forming, and similar work required to support glazed aluminum wall system.
2. Field measure and verify governing dimensions, including floor elevations, floor-to-floor heights, minimum clearance between wall system and structural frames and other permissible dimensional tolerances in building frame.

a. Survey all embeds and floor elevations to confirm correct location above established benchmarks.

3.4 INSTALLATION OF GLAZED ALUMINUM FRAMING SYSTEMS

A. General:

1. Do not install damaged components.
2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure non-movement joints.
4. Install anchors with separators and isolators to prevent impediments to movement of joints.
5. Do not cut, trim, weld or braze component parts during erection, in any manner which would damage finish, decrease strength or result in visual imperfection or failure in performance of construction.
6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints within glazed aluminum framing system according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

B. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum framing systems to exterior.

C. Set continuous sill members and flashing in full sealant bed and install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades, and without warp or rack. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers. Maintain minimum clearance of 1 in (25 mm) between inside face of framing system and outside face of building structure.

E. Operable window vent systems: Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Comply with Division 08 Section Glazing for glass and glazing requirements.

1. Structural-Sealant Glazing:

a. Prepare surfaces that will contact structural-sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
b. Preparation includes, but is not limited to, cleaning and priming surfaces.

G. Perimeter Fire-Containment System for Curtain Wall Spandrel Conditions: Clean debris from behind framing during erection and provide temporary closures to prevent accumulation of debris. Install spandrel insulation and firestopping securely anchored to prevent dislocation. Comply with requirements of Division 07 Section Fire-Resistive Joint Systems.

H. Back Pans: Install with EPDM spacers and maintain air space between pan and interior surface of glass. Seal joints in pan and at perimeter of pan.

1. Ventilate air space between shadow box back pan and interior surface of glass when recommended by manufacturer.

3.5 ERECTION TOLERANCES

A. Erection Tolerances: Install to comply with the following non-accumulating maximum erection tolerances:

1. Plumb: 1/8 in per 10 ft (3 mm per 3 m); 1/4 in per 40 ft (6 mm per 12 m).
2. Level: 1/8 in per 10 ft (3 mm per 3 m); 1/4 in per 40 ft (6 mm per 12 m).
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 in (12 mm) wide, limit offset from true alignment to 1/16 in (1.5 mm).
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 in (12 to 25 mm) wide, limit offset from true alignment to 1/8 in (3 mm).
c. Where surfaces are separated by reveal or protruding element of 1 in (25 mm) wide or more, limit offset from true alignment to 1/4 in (6 mm).

4. Location and Plane: Limit variation from plane to 1/8 in per 12 ft (3 mm per 3.6 m); 1/2 in (12 mm) over total length.

3.6 FIELD QUALITY CONTROL

A. Manufacturer Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

C. Special Inspections: Owner will engage a qualified special inspector to perform special inspections and prepare reports:

1. Erection of glazed aluminum framing systems in accordance with the Building Code and current ICC-ESR.
2. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

E. Contractor Structural-Sealant Compatibility and Adhesion: Testing and inspecting of representative areas of structural-sealant-glazed curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with manufacturer and specified requirements.

1. Structural-Sealant Adhesion: Test structural-sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.

a. Test a minimum of six (6) areas on each building facade.
b. Repair installation areas damaged by testing.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as framing systems are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.

B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace framing systems and panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.8 ARCHITECTURAL METAL FINISH SCHEDULE

A. Color and Gloss:

B. Color and Gloss: Match sample accepted by Architect.

C. Color Anodic Finish:

1. Color: Light bronze.
2. Color: Medium bronze.
3. Color: Dark bronze.
4. Color: Black.

D. Basis of Design: AMFXX

1. Manufacturer:
2. Product Series:

3. Color Name and Number:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 084513
TRANSLUCENT INSULATING PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Translucent insulating panel assemblies and supplementary items necessary for installation.

1. Wall assemblies.
2. Canopy assemblies.

B. Related Requirements:

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 DEFINITIONS

A. Water Leakage: Uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces, or water that is not contained and drained to the exterior, or water that may damage adjacent materials or finishes. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

1. Uncontrolled: Infiltrated water that is not captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that wets perimeter containment system, wall insulation or exposed interior surfaces.
2. Controlled: Infiltrated water that is captured, controlled or managed by flashings, gutters, and sills to drain to exterior, or water that does not wet perimeter containment system, wall insulation or exposed interior surfaces.

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor

to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include typical unit elevations at 1/2 in (12 mm) scale and details at full scale.
2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
3. Indicate where and how the system deviates from Contract Documents.
4. Shop drawings shall contain seal of a professional engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
5. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.
6. Submittal shall contain statement explaining how proposed system design will accommodate infiltrated and condensate water.
7. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

C. Samples for Verification: In manufacturer's standard size.

1. For each type of panel.
2. For each type of exposed finish for framing members

D. Fabrication Samples: For each framing intersection of assemblies, made from 12 in (300 mm) lengths of full-size components and showing details of the following:

1. Joinery including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Translucent panels.
5. Flashing and drainage.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Energy-Performance Certificates: For translucent panel systems, accessories, and components, from manufacturer.

1. Basis for Certification: Certified by manufacturer for energy performance ratings as determined in accordance with NFRC.

D. U-Value and Condensation Evaluation: Determine system U-Value and provide condensation evaluation using NFRC approved version of Lawrence Berkeley National Laboratory THERM software for simulations. Submit isothermal condensation results, including isothermal graphics, for temperature limits of wall system components.

E. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

F. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

G. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1. Structural-Sealant Glazing: For structural-sealant glazing, include ASTM C 1401 recommendations for post-installation-phase, quality-control program.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.

3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

D. Energy-Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1. Provide NFRC-certified, translucent panel systems with an attached label.

1.8 MOCKUPS

A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.9 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.

f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect materials according to manufacturer's written instructions.

B. Prevent damage to framing, panels and glazing materials from abrasion, soiling, contamination, wetting or condensation, temperature changes, direct exposure to sun, or other causes.

1. Use crating, stacking and storage procedures that prevent damage to finishes and gaskets.

1.11 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.12 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.13 WARRANTY

A. Manufacturer’s Warranty: Furnish manufacturer’s written material and labor warranty signed by an authorized representative using manufacturer’s standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. “Defects” is defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Loosening or weakening of fasteners, attachments, and other components.
d. Deterioration of metals and other materials beyond normal weathering.
e. Water penetration through fixed glazing and framing areas.
f. Air infiltration exceeding performance requirements.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion

B. Installers Warranty: Furnish installer’s written workmanship warranty signed by an authorized representative using installer’s standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. Defects is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

C. Factory Applied Finish Warranty for Fluoropolymer Finishes: Furnish manufacturers written warranty signed by an authorized representative using manufacturers standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Coverage includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

D. Factory Applied Finish Warranty for Anodic Finishes: Furnish manufacturers written warranty signed by an authorized representative using manufacturers standard form agreeing to repair finish or replace work which exhibits finish defects. Defects is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As indicated or scheduled in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:

1. Live Load Deflection: Accommodate differential vertical deflection of floors:
   a. Deflection: As indicated on Drawings.
   b. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement and 1.5 times the design displacement.
2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:
   a. Design Displacement: As indicated on Drawings.
   b. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement and 1.5 times the design displacement.

D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

E. Deflection of Panels: At design wind load.
   1. Center-of-Panel Deflection: Deflection at the center of individual panels perpendicular to the wall plane shall be limited to L/60 of the panel short span, or 1.0-inch (25.4 mm) maximum, whichever is less, with no permanent material deformation or structural component failure.

F. Structural Test Performance: Test according to ASTM E 330/330M as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

G. Water Penetration under Static Pressure: Test in accordance with ASTM E 331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf (576 Pa).

H. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 12 lbf/sf (576 Pa).

I. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
   1. Provide drainage to exterior of wall for water entering at joints or glazing reveals, condensation occurring within assemblies, secondary water from adjacent wall systems and similar conditions.
      a. Provide internal gutters and weep system to collect and drain water leakage and condensation to the exterior.
      b. Coordinate gutter and weep systems with drainage provisions with adjacent construction.

c. The use of carbon steel components for gutter and drainage assemblies is prohibited; provide stainless steel or aluminum components.

J. Energy Performance: Certified and labeled by manufacturer for energy performance ratings in accordance with NFRC.

1. Thermal Transmittance (U-Factor) - Fixed Vision Glazing and Framing Areas: U-factor as determined in accordance with NFRC 100.

a. Maximum U-Factor: As indicated on Drawings, comply with building energy performance model for this project.

2. Solar Heat Gain Coefficient (SHGC) - Fixed Glazing and Framing Areas: Solar Heat Gain Coefficient as determined in accordance with NFRC 200.

a. Maximum SHGC: As indicated on Drawings, comply with building energy performance model for this project.

3. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sf (0.30 L/s/sm) at a minimum static-air-pressure differential of 6.24 lbf/sf (300 Pa) when tested in accordance with ASTM E 283.

4. Condensation Resistance: Condensation resistance as determined in accordance with NFRC 500.

a. Fixed Glazing and Framing Areas: No condensation allowed under design conditions indicated.

K. Building Maintenance Equipment: Engineer units supporting building maintenance equipment to resist pull-out and horizontal shear forces transmitted from equipment.

L. Windborne-Debris-Impact-Resistance Performance: Comply with missile impact and cyclic-pressure testing requirements for Wind Zone and facility type.

M. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance.

a. Fabrication, assembly and erection procedures shall take into consideration the ambient temperature range at the time of each operation.

N. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

A. Assembly Description: Translucent assemblies that are supported by aluminum framing and glazed with structured-polycarbonate panels.

1. Manufacturers:

a. Kingspan CPI Daylighting.

B. Structured-Polycarbonate Panels: Translucent, extruded-polycarbonate sheet with multiwall cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.

1. Single Layer Panel: Single-panel, multi-wall polycarbonate panel system consisting of internal honeycomb structure.

a. Basis of Design: Kingspan CPI Daylighting; Pentaglas.

1) Panel Thickness: As required to comply with performance requirements and as recommended by manufacturer for this application.
2) Panel Width: As recommended in writing by manufacturer.
3) Roof-Covering Classification: Class B, Burning Brand Test in accordance with ASTM E108 or UL 790.

2. Multi-Layer Panel: Multi-layer panel polycarbonate panel system consisting of two independent panels assembled into a factory-unitized sandwich panel.

a. Basis of Design: Kingspan CPI Daylighting; UniQuad Unitized System.

1) Panel Thickness: As required to comply with performance requirements and as recommended by manufacturer for this application.
2) Panel Width: As recommended in writing by manufacturer.
3) Roof-Covering Classification: Class A, Burning Brand Test in accordance with ASTM E108 or UL 790.

3. UV Resistance: On both surfaces.
4. Color: As selected by Architect from manufacturer's full range.
5. Panel Performance:

a. Plastic Self-Ignition Temperature: 650 deg F (343 deg C) or more in accordance with ASTM D1929.
b. Smoke-Developed Index: 450 or less in accordance with ASTM E84, or 75 or less in accordance with ASTM D2843.
c. Combustibility Classification: Class CC1 based on testing in accordance with ASTM D635.
d. Interior Finish Classification: Class A based on testing in accordance with ASTM E84.
e. Color Change: Not more than 3.0 units Delta E, when measured in accordance with ASTM D2244, after outdoor weathering compliant with procedures in ASTM D1435.

1) Outdoor Weathering Conditions: Sixty months in Arizona or 120 months in a moderate North American climate.

f. Impact Resistance: No failure at impact of 200 ft. x lbf (271 J) in accordance with freefalling-ball impact test using a 3-1/2-inch- (89-mm-) diameter, 6.3-lb (2.9-kg) ball.
g. Haze Factor: Greater than 90 percent when tested in accordance with ASTM D1003.

2.5 FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

A. Fiberglass-Sandwich-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with fiberglass-sandwich panels.

a. Kalwall Corporation
b. Skywall Translucent Systems

B. Fiberglass-Sandwich Panels: Uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.

C. Panel Thickness: 2-3/4 inches (70 mm).

D. Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16 inch (11.1 mm).

1. Extruded Aluminum: ASTM B221 (ASTM B221M), in alloy and temper recommended in writing by manufacturer.
2. I-Beam Construction: Thermally broken, extruded aluminum.
3. Grid Pattern: Inline rectangle, nominal 12 by 24 inches (305 by 610 mm)].

E. Exterior Face Sheet:

1. Thickness: 0.070 inch (1.78 mm).
2. Color: As selected by Architect from manufacturer's full range.
3. Protective Weathering Surface: Integral, embedded-glass erosion barrier or surface-applied, polyvinyl-fluoride film not less than 1.0 mil (0.03 mm) thick.

F. Interior Face Sheet:

1. Thickness: 0.045 inch (1.14 mm).
2. Color: As selected by Architect from manufacturer's full range.

G. Fiberglass-Sandwich-Panel Adhesive: Manufacturer's standard for permanent adhesion of facings to cores.

H. Panel Performance:

1. Self-Ignition Temperature: 650 deg F (343 deg C) or more in accordance with ASTM D1929.
2. Smoke-Developed Index: 450 or less in accordance with ASTM E84, or 75 or less in accordance with ASTM D2843.
3. Combustibility Classification: Class CC1 based on testing in accordance with ASTM D635.
4. Roof-Covering Classification: Class A, Burning Brand Test in accordance with ASTM E108 or UL 790.
5. Interior Finish Classification: Class A based on testing in accordance with ASTM E84.
6. Color Change: Not more than 3.0 units Delta E, when measured in accordance with ASTM D2244, after outdoor weathering compliant with procedures in ASTM D1435.

a. Outdoor Weathering Conditions: Sixty months in southern Florida.

7. Impact Resistance: No fracture or tear at impact of 60 ft. x lbf (81 J) by a 3-1/4-inch-(83-mm-) diameter, 5-lb (2.3-kg) freefalling ball in accordance with UL 972 test procedure.
8. Haze Factor: Greater than 90 percent when tested in accordance with ASTM D1003.

2.6 ALUMINUM FRAMING SYSTEMS

A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken, extruded aluminum.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B209 (ASTM B209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).
3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
4. Structural Profiles: ASTM B308/B308M.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning components.

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.

1. At closures, retaining caps, or battens, use ASTM A193/A193M, 300 series stainless steel screws.
2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153Mrequirements.

F. Anchor Bolts: ASTM A307, Grade A, galvanized steel.

G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Exposed Flashing and Closures: Aluminum sheet not less than 0.040 inch (1.02 mm) thick, finished to match framing.

I. Framing Gaskets: Manufacturer's standard.

J. Refer to Division 07 Section Sealants and as recommended in writing by manufacturer.

K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

A. Frame System Fabrication:

1. Fabricate components that, when assembled, have the following characteristics:

a. Profiles that are sharp, straight, and free of defects or deformations.
b. Accurately fitted joints with ends coped or mitered.
c. Internal guttering systems or other means to drain water passing through joints, and moisture migrating within assembly to exterior.

2. Fabricate sill closures with weep holes and for installation as continuous component.
3. Reinforce components as required to receive fastener threads.

B. Panel Fabrication: Factory-assemble and seal panels.

1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.

a. White spots indicating lack of bond at intersections of grid-core members are limited in number to four for every 40 sq. ft. (3.7 sq. m) of panel and limited in diameter to 3/64 inch (1.2 mm).

2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
3. Fabricate panel to allow condensation within panel to escape.
4. Reinforce panel corners.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

D. Selections: As scheduled or as indicated in Design Selections.

2.9 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Selections: As scheduled or as indicated in Design Selections.

B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

C. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

D. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF TRANSLUCENT PANEL ASSEMBLIES

A. General: Comply with manufacturer's written instructions.

1. Do not install damaged components.
2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure nonmovement joints.
4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
5. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install components plumb and true and in alignment with established lines and elevations.

D. Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Install components to drain water passing through joints and moisture migrating within assembly to exterior.

E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:

1. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m), but no greater than 1/2 inch (12 mm) over total length.

3.5 FIELD QUALITY CONTROL

A. Manufacturer Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

C. Special Inspections: Owner will engage a qualified special inspector to perform special inspections and prepare reports:

1. Erection of translucent panel systems in accordance with the Building Code and current ICC-ESR.
2. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as framing systems are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.

B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace framing systems and panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.7 ARCHITECTURAL METAL FINISH SCHEDULE

A. Color and Gloss:

B. Color and Gloss: Match sample accepted by Architect.

C. Color Anodic Finish:

1. Color: Light bronze.
2. Color: Medium bronze.
3. Color: Dark bronze.
4. Color: Black.

D. Basis of Design: AMFXX

1. Manufacturer:

2. Product Series:
3. Color Name and Number:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 085619
SLIDING PASS-THRU WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes sliding pass-thru windows and supplementary items necessary to complete work required for their installation.

B. Related Sections:

1. Refer to Division 8 Sections Coiling Counter Doors and Overhead Coiling Doors for roll down fire-rated counter shutters or doors for use with non-fire-rated sliding pass windows located at fire-rated partitions.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

1.4 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 NON-FIRE-RATED, HORIZONTAL FRAMELESS SLIDING WINDOW (TYPE SW-X)

A. Manual Side Sliding Window Unit: Two operable window panes with top and bottom tracks. Recess tracks unless indicated otherwise.

1. Basis of Design: EPCO; Packaged Glass Door Track Assemblies, Assembly #16; Size(s) as indicated on drawings.

a. Clear anodized aluminum frame finish.
b. Manufacturer's standard ratchet lock with bright chrome finish.

1) EPCO Part No. G04-C; include side jambs at both sides (Part No. 730).

c. 1/4 in (6 mm) thick, clear tempered glass windows.

2. Manufacturers:

a. EPCO
b. Hafele
c. Knape & Vogt

2.4 NON-FIRE-RATED, HORIZONTAL FRAMED SLIDING WINDOW, SELF-CLOSING (TYPE SW-X)

A. Manual Side Sliding Window Unit, Self-Closing: One operable window panel, manually operated, self-closing by releasing operable panel. Recess tracks unless indicated otherwise.

1. Basis of Design: QuikServ, Inc.; SC Series LP, Side Sliding Low-Profile Transaction Window, Custom size(s) as indicated on drawings.

a. Clear anodized aluminum frame finish.
b. Manufacturer's standard security locking systems.
c. Automatically locks every time the door closes.
d. 1/4 in (6 mm) thick, clear tempered glass windows.
e. Right or left-hand units, as indicated on Drawings.
f. Custom window sizes.

2.5 NON-FIRE-RATED, HORIZONTAL FRAMED BI-FOLDING WINDOW (TYPE SW-X)

A. Manual Bi-Folding Window Unit: Two simultaneously opening window panels, manually operated. Recess tracks unless indicated otherwise.

1. Basis of Design: QuikServ, Inc.; CM-1 Bi-Fold Transaction Window; Custom size(s) as indicated on drawings.

a. Clear anodized aluminum frame finish.
b. Manufacturer's standard security locking systems, locking bar and slide-bolt locks.
c. 1/4 in (6 mm) thick, clear tempered glass windows.
d. Custom window sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting

performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

C. Preparation, General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 087100
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Door hardware, accessories, and supplementary items necessary for a complete installation.

B. Contractor Furnished, Owner Installed Products: Contractor shall coordinate, purchase, deliver and store products on site as directed by the Owner.

1. Lock cylinders.
2. Permanent cores.

1.2 ALLOWANCES

A. Door Hardware Allowance:

1. Typical Openings: Include $1300.00 per leaf per opening for purchase, freight, delivery, and installation of door hardware for non-electrified openings.
2. Electrified Openings: Include $3000.00 per leaf per opening for purchase, freight, delivery, and installation of door hardware for electrified openings.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each item of door hardware indicated, specified, or required.

1. Include material descriptions, dimensions of individual components and profiles, finishes, and installation instructions.
2. Index product data sheets according to hardware schedule by use of numbers or letters, or combination.

B. Shop Drawings: For electrified door hardware.

1. Wiring Diagrams: Indicate power, signal, and control wiring detailed in following forms distinguishing between manufacturer-installed and field-installed wiring:

a. System schematic.
b. Point-to-point wiring diagrams.
c. Riser diagrams.
d. Door opening elevations.

2. Interface: Details between electrified hardware and fire alarm, access control, security, and building control system.
3. Sequence of Operation: Narrative operation description of doors controlled by electrified hardware.

C. Samples for Verification: When requested by Architect. For each type of exposed product, each finish specified.

1. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.

a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

2. Tag Samples with full product description to coordinate Samples with door hardware schedule.

D. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of product data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence, format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
e. Fastenings and other installation information.
f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
g. Mounting locations for door hardware.
h. List of related door devices specified in other Sections for each door and frame.

E. Additional Specific Information: Include type of strike plates; length of spindle, hand, backset and bevel of locks; hand and degree opening for closers; length of kickplates; length of rods for flush bolts; type of door stops; and other mechanism/functions.

F. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers Project Acceptance Document: Certification that products are approved, acceptable, or suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that warranty will be issued.

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

1. Operational and Maintenance Training: Training materials, including instructor qualifications, required by Close-Out Activities.

B. Schedules: Final door hardware and keying schedule.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Materials: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware: As determined by Owner.
2. Electrical Parts: As determined by Owner.

1.7 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 10 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Supplier Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
4. Experience: Company with not less than 10 years of experience in performing specified Work similar in scope of this Project; with a record of successful in-service performance; and sufficient capability, facilities, and personnel, to produce required Work.
5. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and who is experienced in installing systems similar in type and scope required for Project.
6. Manufacturer Training: Technical representatives of manufacturer of locksets, exit devices and closers shall train Installer’s installation personnel (supervisor and installers), either at Project or at manufacturers facility on the proper installation of products.

C. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC).

D. Electrified Hardware Technician Qualifications: A person with a minimum of 5 years of experience in low voltage installations and who is available during the course of the Work to consult with Contractor, Architect, and Owner.

1.8 PRECONSTRUCTION TESTING

A. Pre-Construction Extended Performance Testing: Manufacturer shall, through its own laboratory testing facilities witnessed and verified by Intertek, Underwriters Laboratories, Inc., or other testing laboratory agency acceptable to Architect, perform pre-construction testing to establish compliance of proposed Work with specified requirements.

1. Requirements: Test hardware items extended cycle performance as indicated.
2. Test Method: ANSI/BHMA Grade 1.
3. Reports: Prepare certified reports tabulating test results and indicating whether hardware items meet or exceed requirements indicated.
4. Equivalent Option to Testing: Testing is not required when manufacturers have tested hardware items within the previous 5 years.

1.9 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including supervisor.
c. Supplier architectural hardware consultant.
d. Hardware installer, including supervisor.
e. Security installer, including supervisor.
f. Manufacturer technical representative.

2. Minimum Agenda: Installer shall demonstrate understanding of Work required by reviewing and discussing procedures for, but not limited to, following:

a. Tour representative areas of required Work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of installation and other preparatory Work performed by other installers.

1) Prior to installation of door hardware, conduct a project specific training meeting to instruct the installer's personnel on installation and adjustment of their products.
2) Training shall include the use of installation manuals, hardware schedules, templates and hardware samples as required.

b. Review Contract Document Requirements.
c. Review approved submittals.
d. Review installation procedures, including, but not limited to, following:

1) Installation requirements for each hardware item.
2) Sequence of operation for each type of electrified door hardware.

a) Review electrical roughing-in, power supply connections, and other preparatory work performed by other trades.

3) Review relationships between electrified hardware and fire alarm, access control, security, and building control system.

e. Review required inspection, testing, certifying, and material usage accounting procedures. Review commissioning and demonstration procedures.

3. Reports: Record discussions, including decisions and agreements reached, and furnish a copy of record to each party attending.

B. Keying Conference: Conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including supervisor.
c. Supplier architectural hardware consultant.
d. Hardware installer, including supervisor.
e. Security installer, including supervisor.
f. Manufacturer technical representative.

2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system, including, but not limited to, the following:

a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

1) Plans for existing and future key system expansion.

b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Installation of permanent keys, cylinder cores and software.
f. Address for delivery of keys.

3. Reports: Record discussions, including decisions and agreements reached, and furnish a copy of record to each party attending.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lockup for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.11 COORDINATION

A. Coordinate application of products and systems with interfacing and adjoining construction to provide a successful application without failure.

B. Floor-Recessed Door Hardware: Coordinate layout and installation with floor construction.

1. Cast anchoring inserts into concrete.

C. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

D. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

E. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

F. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field-verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.12 WARRANTY

A. Manufacturer Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Mortise Locksets: 10 years on mechanical components and 2 years on electrical components from date of Substantial Completion.
b. Bored Locksets: 7 years on mechanical components and 2 years on electrical components from date of Substantial Completion.
c. Electromagnetic and Delayed-Egress Locks: 5 years from date of Substantial Completion.
d. Exit Devices: 5 years on mechanical components and 2 years on electrical components from date of Substantial Completion.
e. Overhead Manual Closers: 25 years from date of Substantial Completion.
f. Concealed Floor Closers: 10 years from date of Substantial Completion.
g. Electrified Hardware: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Sections.

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed alphabetically below.

C. Basis of Design: Contract Documents are based on products specified in Door Hardware Sets below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and do not change intent of Contract Documents as judged by Architect.

2.2 HARDWARE, GENERAL

A. Source Limitations: Obtain each type of door hardware from a single manufacturer.

1. Provide electrified door hardware from the same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

C. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105 for conditions indicated.

D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

F. Accessibility Requirements: Comply with applicable provisions in the ADA Accessibility Standards, ABA Accessibility Standards and the Building Code.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.4 HINGES

A. Hinges: ANSI/BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Hager Companies (HAG).
b. Ives Hardware; an Allegion Company (IVE).
c. Stanley Commercial Hardware; Division of Dorma-Kaba (STH).

3. Hinge Quantity:

a. Doors up to 60-inches in Height: Two hinges.
b. Doors 61-inches to 90-inches in Height: Three hinges.
c. Doors 91-inches to 120-inches in Height: Four hinges.
d. Doors more than 120-inches in Height: Four hinges plus one hinge for each 30-inches of door height greater than 120-inches.

4. Hinge Size: Unless indicated otherwise. Hinge widths sized for door thickness and required clearances.

a. Doors up to 36-inches in Width: 4-1/2-inch standard weight or heavy weight.
b. Doors 37-inches to 48-inches in Width: 5-inch standard weight or heavy weight.

B. Antifriction-Bearing Hinges:

1. Locations: Grade 1 (heavy weight), unless indicated otherwise.

a. Fire-rated doors.
b. Doors with closers.
c. Exterior doors.

2. Locations: Grade 2 (standard weight), unless indicated otherwise.

a. Interior doors.

3. Mounting: Full mortise (butts).

4. Bearing Material: Manufacturer's standard antifriction bearing or ball bearing, as scheduled.
5. Base and Pin Metal: Unless scheduled otherwise.
   a. Exterior Hinges: Stainless steel with stainless steel pin.
   b. Interior Hinges: Steel with steel pin.
6. Pins:
   a. Outswinging Exterior Doors: Nonremovable or safety stud.
   b. Outswinging Corridor Doors with Locks: Nonremovable or safety stud.
   c. Interior Doors: Nonrising loose unless indicated otherwise.
7. Tips: Flat button typical, provide hospital tip (HT) where indicated.
8. Corners: Square.

C. Electrified Antifriction-Bearing Hinges:
1. Locations: Grade 1 (heavy weight), unless indicated otherwise.
   a. Fire-rated doors.
   b. Doors with closers.
   c. Exterior doors.
2. Locations: Grade 2 (standard weight), unless indicated otherwise.
   a. Interior doors.
3. Mounting: Full mortise (butts).
4. Bearing Material: Manufacturer's standard antifriction bearing or ball bearing.
5. Base and Pin Metal:
   a. Exterior Hinges: Stainless steel with stainless steel pin.
   b. Interior Hinges:Steel with steel pin.
6. Pins:
   a. Outswinging Exterior Doors: Nonremovable or safety stud.
   b. Outswinging Corridor Doors with Locks: Nonremovable or safety stud.
   c. Interior Doors: Nonrising loose unless indicated otherwise.
7. Tips: Flat button typical, provide hospital tip (HT) where indicated.
8. Corners: Square.
9. Electric Feature: Concealed electric through wires and other features as scheduled.

D. Plain-Bearing Hinges: Grade 3 (standard weight).
1. Locations: Grade 3 (standard weight), unless indicated otherwise.
   a. Interior doors, residential units.
2. Mounting: Full mortise (butts)..
3. Base and Pin Metal:
   a. Interior Hinges: Steel with steel pin.
4. Pins:
   a. Interior Doors: Nonrising loose unless otherwise indicated.
5. Tips: Flat button typical.
6. Corners: Square.

2.5 CENTER-HUNG AND OFFSET PIVOTS

A. Center-Hung and Offset Pivots: ANSI/BHMA A156.4.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
b. IVES Hardware; an Allegion Company (IVE).
c. Rixson Specialty Door Controls; an ASSA ABLOY Group Company (RIX).

B. Center-Hung Pivot Sets: Grade 1.

1. Top Pivots: Walking-beam type with retractable pin and oil-impregnated bronze bearing; mortised into door and frame.
2. Bottom Pivots: mortised into door.

a. Bearing: Thrust ball or Needle.

C. Offset Pivot Sets: Grade 1

1. Top Pivot: Walking-beam type with retractable pin and oil-impregnated bronze bearing.
2. Bottom Pivot: mortised into door

a. Bearing: Thrust ball or Needle.

D. Offset Pivot Sets for Lead Lined Doors: Grade 1, heavy weight, full-mortise, single-acting, offset mounting, fire rated when required, lead-lined when required, approved for weight of lead lined door.

1. Top Pivot: Walking-beam type with retractable pin and oil-impregnated bronze bearing.
2. Bottom Pivot: mortised into door

a. Bearing: Thrust ball or Needle.

E. Offset Intermediate Pivots: Grade 1; for use with offset pivot sets; with oil-impregnated bronze bearings.

F. Pocket Pivots: Grade 1; full-mortise mounting; non-handed; allows door to nest in pocket with door surface flush with corridor wall when open; maximum 90-degree swing.

2.6 CONTINUOUS HINGES

A. Continuous, Pin-and-Barrel-Type Hinges: ANSI/BHMA A156.26, Grade 1; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

1. Locations;

a. Hollow metal doors at loading dock and central plant.
b. Other locations as indicated in door hardware schedule.

2. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
3. Manufacturers:

a. Hager Companies (HAG).
b. Ives; an Allegion Company (IVE)

c. Markar Architectural Products, Inc.; a Subsidiary of Adams Rite Manufacturing Company (MP).
d. Select Products Limited (SPL).
e. Stanley Commercial Hardware; Division of Dorma-Kaba (STH)
f. Zero International; an Allegion Company (ZER).

4. Exterior Hinges: Stainless steel.
5. Interior Hinges: Stainless steel, Steel or Aluminum.
6. Hinges for Fire-Rated Assemblies: Stainless steel with steel fire pins to hold fire-rated doors in place when required by tested listing.
7. Electric Feature: Concealed electric through wires and other features as scheduled.

B. Continuous, Gear-Type Hinges: ANSI BHMA A156.26, Grade 1; minimum 0.120-inch-(3.0-mm-) thick, extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings. Minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Architectural Builders Hardware (ABH).
b. Hager Companies (HAG).
c. Ives; an Allegion Company (IVE).
d. Pemko Manufacturing Company; an ASSA ABLOY Group Company (PEM).
e. Select Products Limited (SPL).
f. Zero International; an Allegion Company (ZER).

3. Hinges for Fire-Rated Assemblies: With steel fire pins to hold fire-rated doors in place when required by tested listing.
4. Electric Feature: Concealed electric through wires and other features as scheduled.

2.7 CONCEALED HINGES

A. Concealed Hinges: Fully concealed within mortises in the door edge and frame and allowing door to swing open 180 degrees.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Electric Feature: Concealed electric through wires and other features as scheduled.

2.8 MECHANICAL LOCKS AND LATCHES, GENERAL

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
3. Deadbolts: Minimum 1-inch (25-mm) bolt throw.

C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated in door hardware schedule.
2. Levers: Cast.

3. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finish to match lock or latch. Provide minimum lip strike projection from trim.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide locksets for rabbeted meeting stiles.

F. Bored Locks and Latches: ANSI/BHMA A156.2, Grade 1, except cycle testing shall be 2 million cycles minimum.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Best Access Systems; Division of Dorma-Kaba (BAS); 9K Series.
b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR); CL 3100 Series.
c. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT); 10 Line Series.
d. Schlage Commercial Lock Division; an Allegion Company (SCH); ND Series.

G. Bored Locks and Latches: ANSI/BHMA A156.2, Grade 1, except cycle testing shall be 1 million cycles minimum. Grade 2 may be used for certain applications as scheduled.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Best Access Systems; Division of Dorma-Kaba (BAS); 9K Series.
b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR); CL3300 Series.
c. Falcon Lock; an Allegion Company (FAL); T Series.
d. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT); 10 Line.
e. Accentra Commercial Locks and Hardware; an ASSA ABLOY Group Company (ACC); 5400LN Series.

H. Bored Locks and Latches: ANSI/BHMA A156.2, Grade 2.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Best Access Systems; Division of Dorma-Kaba (BAS); 7KC Series.
b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR); CL3700 Series.
c. Falcon Lock; an Allegion Company (FAL); W Series.
d. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT); 7 Line.
e. Schlage Commercial Lock Division; an Allegion Company (SCH); ALX Series.
f. Accentra Commercial Locks and Hardware; an ASSA ABLOY Group Company (ACC); 5300LN Series.

I. Bored Locks and Latches: ANSI/BHMA A156.2, Grade 2.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

   a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR); TL3700 Series.
   b. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH); CL600 Series (Grade 2).
   c. Schlage; an Allegion Company (SCH) F Series.
   d. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT); DL Series.
   e. Accentra Commercial Locks and Hardware; an ASSA ABLOY Group Company (ACC); 4300LN Series.

J. Mortise Locks and Latches: ANSI/BHMA A156.13, Operational Grade 1, Security Grade 1

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

   a. Best Access Systems; Division of Dorma-Kaba (BAS); 45 H Series.
   b. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT); 8200 Series.
   c. Schlage Commercial Lock Division; an Allegion Company (SCH); L9000 Series.

3. Manufacturers:

   a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR); ML2000 Series.
   b. Falcon Lock; an Allegion Company (FAL); MA Series.
   c. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT); 7900 Series.
   d. Accentra Commercial Locks and Hardware; an ASSA ABLOY Group Company (ACC); 8800 Series.

K. Roller Latches: ANSI/BHMA A156.16, Grade 1; rolling plunger that engages socket or catch, with adjustable roller projection.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Mounting: Mortise.

L. Hospital Push-Pull Latches: Mortise, ANSI/BHMA A156.13, Grade 1; with paddle handles that retract latchbolt; mounted vertically.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

   a. Architectural Builders Hardware (ABH).
   b. Glynn-Johnson; an Allegion Company (GJ).
   c. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT).
   d. Rockwood Manufacturing Company (ROC)

3. Lettering: Engrave with the words "Pull" and "Push."; push handle pointing downward and pull handle pointing upward.

2.9 AUXILIARY LOCKS

A. Bored Auxiliary Locks: ANSI/BHMA A156.36, Grade 1; with strike that suits frame.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Accurate Lock & Hardware Company (ALH).
b. Adams Rite Manufacturing Company (ARM).
c. Best Access Systems; Division of Dorma-Kaba (BAS).
d. Falcon Lock; an Allegion Company (FAL).
e. Medeco Security Locks, Inc.; an ASSA ABLOY Group Company (MED).
f. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT).
g. Schlage Commercial Lock Division; an Allegion Company (SCH).

3. Deadlatches: Deadlocking latchbolt operated by key outside and turn inside.
4. Deadlocks: Deadbolt operated by key outside and turn inside.

B. Mortise Auxiliary Locks: ANSI/BHMA A156.36, Grade 1; with strike that suits frame.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Accurate Lock & Hardware Company (ALH).
b. Adams Rite Manufacturing Company (ARM).
c. Best Access Systems; Division of Dorma-Kaba (BAS).
d. Falcon Lock; an Allegion Company (FAL).
e. Medeco Security Locks, Inc.; an ASSA ABLOY Group Company (MED).
f. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT).
g. Schlage Commercial Lock Division; an Allegion Company (SCH).

3. Deadlatches: Deadlocking latchbolt operated by key outside and turn inside.
4. Deadlocks: Deadbolt operated by key outside and turn inside.

C. Push-Button Combination Locks: ANSI/BHMA A156.36, cylindrical, Grade 1; lock opens by entering a one- to five-digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed; with strike that suits frame.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.

2.10 ELECTRIC STRIKES

A. Electric Strikes: ANSI/BHMA A156.31, Grade 1; with faceplate to suit lock and frame.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Adams Rite Manufacturing Company (ARM).
b. Folger Adam Security, Inc.; an ASSA ABLOY Group Company (FAS).
c. HES, Inc.; an ASSA ABLOY Group Company (HES).
d. Rutherford Controls International Corporation (RCI).
e. Security Door Controls (SDC).
f. Von Duprin; an Allegion Company (VON).

3. Mounting: Mortised.
4. Fire-Rated Door Assemblies: Use fail-secure electric strikes with fire-rated devices.

2.11 ELECTROMAGNETIC LOCKS

A. Electromagnetic Locks: ANSI/BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Dortronics Systems, Inc. (DS).
b. DynaLock Corporation (DLC).
c. Schlage; an Allegion Company (LSE).
d. Rutherford Controls International Corporation (RCI).
e. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT).
f. Securitron Magnalock Corporation; an ASSA ABLOY Group Company (SMC).
g. Security Door Controls (SDC).

3. Inductive Kickback Peak Voltage: Not more than 0 V.
4. Residual Magnetism: Not more than 0 lbf (0 N) to separate door from magnet.

B. Delayed-Egress Electromagnetic Locks: ANSI/BHMA A156.24; electrically powered; with electromagnet attached to frame and armature plate attached to door; depressing push bar for more than three seconds initiates irreversible alarm and adjustable time delay for egress. When integrated with fire alarm, fire alarm voids time delay.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Dortronics Systems, Inc. (DS).
b. DynaLock Corporation (DLC).
c. Schlage; an Allegion Company (LSE).
d. Rutherford Controls Int'l. Corporation (RCI).
e. SARGENT Manufacturing Company; an ASSA ABLOY Group Company (SGT).
f. Securitron Magnalock Corporation; an ASSA ABLOY Group Company (SMC).
g. Security Door Controls (SDC).

3. Grade: Security grade, activated from secure side of door by initiating device.

2.12 ELECTROMECHANICAL MORTISE LOCKS

A. Electromechanical Locks: ANSI/BHMA A156.25, Grade 1; motor or solenoid driven; with strike that suits frame.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Best Access Systems; Division of Dorma-Kaba (BAS).
b. Corbin Russwin; an ASSA ABLOY Group Company (CR).
c. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT).
d. Schlage Commercial Lock Division; an Allegion Company (SCH).
e. Security Door Controls (SDC).
f. Accentra Commercial Locks and Hardware; an ASSA ABLOY Group Company (ACC).

3. Type: Fail safe type (power off unlocks outside lever); provide transformers and wiring necessary to install and connect to building electrical system.

2.13 SELF-CONTAINED ELECTRONIC LOCKS

A. Self-Contained Electronic Locks: ANSI/BHMA A156.25, with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturer:

a. Best Access Systems; Division of Dorma-Kaba (BAS).
b. Corbin Ruswin, an ASSA ABLOY Group Company (CR).
c. Kaba Ilco Inc.; a Kaba Group Company (KAB).
d. SARGENT Manufacturing Company; an ASSA ABLOY Group Company (SGT).
e. Schlage Commercial Lock Division; an Allegion Company (SCH).

3. Actuating Device: Digital keypad, Magnetic-stripe card reader, Smart-card reader or another device as scheduled.

a. Accessory: Card encoder and software.

4. Lock Trim: Match trim specified for mechanical locks.

2.14 EXIT LOCKS AND EXIT ALARMS

A. Exit Locks and Alarms: ANSI/BHMA A156.29, Grade 1.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.

B. Exit Locks: Surface mounted; battery powered, housed in metal case; with manufacturer's standard strike that suits frame; with red-and-white lettering reading "EMERGENCY EXIT PUSH TO OPEN - ALARM WILL SOUND."

1. Activated by arm, push plate, or paddle or horizontal bar.
2. Features:

a. Low-battery alert.
b. Outside key control.
c. Audible alarm that sounds when unauthorized use of door occurs.

C. Standalone Exit Alarms: Surface mounted on door or mounted separate from door and activated by door movement switch.

1. Features:

a. Low-battery alert.
b. Outside key control.
c. Audible alarm that sounds when unauthorized use of door occurs.
d. Automatic rearming after authorized use, with adjustable time delay.

2.15 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: ANSI/BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge, with dustproof strikes.

1. Basis of Design Product, Base Metal, and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Door Controls International (DCI); 780F, 790F.
b. Hager Companies (HAG); 281D.
c. Ives Hardware; an Allegion Company (IVE); FB458, FB358 Series with DP1 or DP2 dustproof strike.
d. Rockwood (ROC); 555/550 with 570 Dustproof Strike.
e. Trimco (TBM); 244B, 3815 with 3910 or 3910N dustproof strike

B. Manual-Extension Flush Bolts: Grade 1, fabricated from brass or bronze, furnished in pairs, (top and bottom of door) with 12-inch (305-mm) rod actuated by flat lever, with dustproof strikes.

1. Strike: Matching top strike, Dustproof bottom strike.
2. Fire Rated: Listed and labeled for use in fire-rated assemblies.

C. Top-Bolt Extension Rod Length: As required to locate operating mechanism at not more than 72 inches (1829 mm) above the finished floor at all times.

D. Dustproof Strikes: Grade 1, polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger.

2.16 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic Flush Bolts: ANSI/BHMA A156.3, Type 25; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge, with dustproof strikes.

1. Basis of Design Product, Base Metal, and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Door Controls International (DCI); 842, 942 Series with No. 80 or No. 81 dustproof strike.
b. Hager Companies (HAG); 291D, 292D, with 280X dustproof strike
c. Ives Hardware; an Allegion Company (IVE); FB30, FB40 Series with DP1 or DP2 dustproof strike.
d. Rockwood (ROC): 2942/2842 with 570 Dustproof Strike.
e. Trimco (TBM); 3810, 3815 with 3910 or 3910N dustproof strike.

B. Self-Latching Flush Bolts: ANSI/BHMA A156.3, Type 27; minimum 3/4-inch (19-mm) throw; with dust-proof strikes; designed for mortising into door edge, with dustproof strikes.

1. Basis of Design Product, Base Metal, and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Door Controls International (DCI); 805, 905 Series with No. 80 or No. 81 dustproof strike.
b. Hager Companies (HAG); 293D, 294D with 280X dustproof strike.
c. Ives Hardware; an Allegion Company (IVE); FB50, FB60 Series with DP1 or DP2 dustproof strike.
d. Rockwood (ROC); 2945/2845
e. Trimco (TBM); 3820, 3825 with 3910 or 3910N dustproof strike.

C. Dustproof Strikes: Grade 1, polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger.

2.17 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: ANSI/BHMA A156.3, Grade 1, except extended cycle performance testing shall be 8 million cycles minimum.

1. Types and Locations:
   a. Touch Bar:
      1) Typical locations unless indicated otherwise.
   b. Concealed Vertical Rods:
      1) Pairs of doors unless surface mounted vertical rods are required for fire rated doors.
   c. Motrtise Lock or Rim Type:
      1) Single doors only.
   d. Provide units with keyed dogging device to hold latch bolt in retracted position when engaged.
      1) Exception: Fire rated doors where closers are installed.
   e. Provide vertical rod devices held in retracted position when door is open.
      1) Exception: Doors with thresholds.
2. Basis of Design Product, Base Metal, Operating Trim and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
3. Manufacturers:
   a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR); ED5000 Series / ED4000 Series Narrow Stile.
   b. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH); 9000 Series.
   c. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT); 19-43-GL 80 Series.
   d. Von Duprin; an Allegion Company (VON); 98/99 Series; 33A / 35A on Narrow Stile.

B. Exit Devices and Auxiliary Items: ANSI/BHMA A156.3, Grade 1, except extended cycle performance testing shall be 4 million cycles minimum.
1. Types and Locations:
   a. Touch Bar:
      1) Typical locations unless indicated otherwise.
   b. Concealed Vertical Rods:
      1) Pairs of doors unless surface mounted vertical rods are required for fire rated doors.
   c. Motrtise Lock or Rim Type:
      1) Single doors only.
   d. Provide units with keyed dogging device to hold latch bolt in retracted position when engaged.
      1) Exception: Fire rated doors where closers are installed.
   e. Provide vertical rod devices held in retracted position when door is open.
      1) Exception: Doors with thresholds.
2. Basis of Design Product, Base Metal, Operating Trim and Finish: As scheduled or indicated in Door Hardware Sets Schedule.

3. Manufacturers:

   a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR); ML2000 Series.
   b. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH); 8000 Series.
   c. Falcon Exit Devices & Door Hardware; an Allegion Company (FAL); 24/25 Series

C. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.

D. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing in accordance with UL 305 and NFPA 252.

E. Electronic Exit Bars: Non-latching electronic actuating (releasing) device activated by an adjustable capacitance sensor and with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum and provide door and frame transfer device and 16 ft. (4.9 m) of cord to route wiring off the door frame.

2.18 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Basis of Design Product, Base Metal, and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

   a. Arrow USA; an ASSA ABLOY Group Company (ARW); Choice HS.
   b. Best Access Systems; Division of Dorma-Kaba (BAS), Kaba Peaks.
   c. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR); Pyramid.
   d. Medeco Security Locks, Inc.; an ASSA ABLOY Group Company (MED); Keymark.
   e. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT); XC
   f. Schlage Commercial Lock Division; an Allegion Company (SCH); Everest.
   g. Accentra Commercial Locks and Hardware; an ASSA ABLOY Group Company (ACC); Keymark.

B. Standard Lock Cylinders: ANSI/BHMA A156.5, Grade 1 permanent cores unless indicated otherwise; face finished to match lockset.

1. Core Type:

   a. Interchangeable: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
   b. Removable: Core insert, removable by use of a special key; for use only with core manufacturer's cylinder and door hardware.

2. Number of Pins: Not less than six.
3. Lock Type: Mortise, Rim or Bored-lock type as scheduled.

C. High-Security Lock Cylinders: ANSI/BHMA A156.30, Grade 1 permanent cores that are removable; face finished to match lockset.

1. Type M, mechanical or Type E, electrical as required.
2. Number of Pins: Not less than six..
3. Lock Type: Mortise, Rim or Bored-lock type as scheduled.

D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

2.19 KEYING

A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide one extra key blank for each lock.

1. No Master Key System: Only change keys operate cylinders.

a. Provide three cylinder change keys.

2. Master Key System: Change keys and a master key operate cylinders.

a. Provide three cylinder change keys and five master keys.

3. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.

a. Provide three cylinder change keys and five each of master and grand master keys.

4. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.

a. Provide three cylinder change keys and five each of master, grand master, and great-grand master keys.

5. Existing System:

a. Master key or grand master key locks to Owner's existing system.
b. Re-key Owner's existing master key system into new keying system.

6. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver or Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

C. Key Control Protection:

1. Level of Key Control Protection: Conventional.
2. Level of Key Control Protection: Restricted patented.
3. Level of Key Control Protection: High security patented.
4. Level of Key Control Protection: High security with UL437 patented protection.

2.20 KEY CONTROL SYSTEM

A. Key Control Cabinet: ANSI/BHMA A156.28; metal cabinet with baked-enamel finish, containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Manufacturers:

a. Key Control Systems, Inc. (KCS).
b. Lund Equipment Co., Inc. (LUN).
c. MMF Industries (MMF).
d. Sunroc Corporation (SUN).

2. Multiple-Drawer Cabinet: Grade 1 cabinet with drawers equipped with key-holding panels, key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.
3. Wall-Mounted Cabinet: Grade 1 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
4. Portable Cabinet: Grade 1 tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.

B. Key Control System Software: Multiple-index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

2.21 OPERATING TRIM

A. Operating Trim: ANSI/BHMA A156.6.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Ives Hardware; an Allegion Company (IVE).
b. Rockwood Manufacturing Company (ROC).
c. Trimco (TBM).

B. Flat Push Plates: With square corners and beveled edges; secured with exposed screws.

1. Thickness: 0.050 inch (1.3 mm).
2. Size: 4 inches wide by 16 inches high (102 mm wide by 406 mm high).

C. Push-Pull Plates: With square corners, beveled edges, and raised integral lip; secured with exposed screws.

1. Thickness: 1/8 inch (3.2 mm).
2. Size: 3-1/2 inches wide by 15-3/4 inches high (89 mm wide by 400 mm high).

D. Straight Door Pulls:

1. Type: 3/4-inch (19-mm) constant-diameterpull.
2. Mounting: Surface applied with concealed fasteners
3. Minimum Clearance: 1-1/2 inches (38 mm) from face of door.
4. Overall Length: 9 inches (229 mm).

2.22 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: ANSI/BHMA A156.3; consisting of active-leaf, hold-open lever, and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Carry-Open Bars: ANSI/BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

2.23 SURFACE CLOSERS

A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

B. Surface Closer with Cover: Grade 1 except cycle testing shall be 6 million cycles minimum; with mechanism enclosed in cover.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group Company (CR); DC 8000 Series.
b. LCN Closers; an Allegion Company (LCN); 4040/4010 Series.
c. SARGENT Manufacturing Company; an ASSA ABLOY Group Company (SGT); 281 Series.
d. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH); 8900 Series.
e. Falcon; an Allegion Company (FAL); SC70 Series.
f. Norton Door Controls; an ASSA ABLOY Group Company (NOR); 9500 Series.
g. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT); 351 Series.

C. Surface Closer with Cover: Grade 1, except cycle testing shall be 4 million cycles minimum; with mechanism enclosed in cover.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Falcon; an Allegion Company (FAL); SC80 Series.
b. Norton Door Controls; an ASSA ABLOY Group Company (NOR). 8500 Series.
c. Sargent Manufacturing Company; an ASSA ABLOY Group Company; 1331/1130 Series.
d. LCN; an Allegion Company (LCN); 4050A Series.

3. Cover Material: Aluminum or Plated steel.
4. Closer Size: As scheduled; comply with manufacturer's recommendations for size of door control unit depending on size and weight of door, exposure to weather, and anticipated frequency of use.

2.24 CONCEALED CLOSERS

A. Concealed Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

B. Concealed Overhead Closer: Grade 1; mortised into head frame; with cast-metal body and exposed cover plate.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.

2. Manufacturers:

   a. LCN Closers; an Allegion Company (LCN); 2010 / 5010 Series.
   b. Sargent Manufacturing Company; an ASSA ABLOY Group Company (SGT); 268 / 278 Series.

3. Manufacturers:

   a. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH); RTS-88 Series.
   b. Rixson Specialty Door Controls; an ASSA ABLOY Group Company (RIX); 70/90 Series according to application.

C. Closer Size: As scheduled; comply with manufacturer's recommendations for size of door control unit depending on size and weight of door, exposure to weather, and anticipated frequency of use.

D. Concealed Floor Closer: Grade 1; with cement case and cast-iron closer body case and top pivot.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

   a. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH); BTS-80 Series.
   b. Rixson Specialty Door Controls; an ASSA ABLOY Group Company (RIX); 27/28 Series according to application.

3. Fire Rated: Listed for use in labeled fire-rated assemblies where indicated.
4. Floor Plates: Provide flush cover plates matching door hardware finish or recessed floor plates with insert of floor finish material and extended closer spindle to accommodate thickness of floor finish unless thresholds are indicated.
5. Closer Size: As scheduled; comply with manufacturer's recommendations for size of door control unit depending on size and weight of door, exposure to weather, and anticipated frequency of use.

2.25 CLOSER HOLDER RELEASE DEVICES

A. Closer Holder Release Devices: ANSI/BHMA A156.15, Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door must become self-closing on interruption of signal to release device.

2.26 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.

B. Rigid-Type Floor Stop: Grade 1; with rubber bumper.

C. Dome-Type Floor Stop: Grade 1; with minimum 1-inch- (25-mm-) high bumper for doors without threshold and 1-3/8-inch- (35-mm-) high bumper for doors with threshold.

1. Provide with extruded-aluminum riser for carpet installations.

D. Manual Combination Floor Stop and Holder: Grade 1; 3-1/2 inches (89 mm) long, with holder, keeper, and rubber bumper.

E. Rescue Door Stop and Two-Way Strike Plate: ANSI 1882; retractable stop allows doors to open in both directions without frame damage for emergency rescue.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Hager Companies (HAG); 455, 457 Series.
b. McKinney Products Company, an ASSA ABLOY Group Company (MCK); CSS-9.

F. Wall Bumpers: Grade 1; with rubber bumper; 2-1/2-inch (64-mm) diameter, minimum 3/4-inch (19-mm) projection from wall; with backplate for concealed fastener installation.

2.27 ELECTROMAGNETIC STOPS AND HOLDERS

A. Electromagnetic Door Holders: ANSI/BHMA A156.15, Grade 1; wall-mounted electromagnetic unit with strike plate attached to swinging door; coordinated with fire detectors and interfaced with fire-alarm system for labeled fire-rated door assemblies.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.

2.28 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: ANSI/BHMA A156.8; Grade 1.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.

2.29 DOOR GASKETING

A. Door Gasketing: ANSI/BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Hager Companies (HAG).
b. National Guard Products (NGP).
c. Pemko Manufacturing Company; an ASSA ABLOY Group Company (PEM).
d. Reese Enterprises (RE).
e. Zero International; an Allegion Company (ZER).

B. Maximum Air Leakage: When tested in accordance with ASTM E283/E283M with tested pressure differential of 0.3 inch wg (75 Pa), as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
3. Gasketing on Double Doors: 0.50 cfm per ft. (0.000774 cu. m/s per m) of door opening.

2.30 THRESHOLDS

A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Hager Companies (HAG).
b. National Guard Products (NGP).
c. Pemko Manufacturing Company; an ASSA ABLOY Group Company (PEM).
d. Reese Enterprises (RE).
e. Rixson Specialty Door Controls; an ASSA ABLOY Group Company (RIX).
f. Zero International; an Allegion Company (ZER).

2.31 SLIDING DOOR HARDWARE

A. Sliding Door Hardware: ANSI/BHMA A156.14; consisting of complete sets, including rails, hangers, supports, bumpers, floor guides, and accessories indicated.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Cox, Arthur & Sons, Inc. (ACS).
b. Hager Companies (HAG).
c. Johnson, L. E. Products, Inc. (LEJ).
d. Lawrence Brothers, Inc. (LB).
e. Pemko Manufacturing Company; an ASSA ABLOY Group Company (PEM).
f. Stanley Commercial Hardware; Division of Dorma-Kaba (STH).

B. Horizontal Sliding Door Hardware: Grade 1; rated for minimum door weight as scheduled.

C. Bypassing Sliding Door Hardware: Grade 1; rated for doors weighing up to 120 lb (54 kg), rails and door hardware that allow vertical adjustment.

D. Pocket Sliding Door Hardware: Grade 1; rated for doors weighing up to 120 lb (54 kg), overhead box rails and door hardware that allows vertical adjustment.

2.32 FOLDING DOOR HARDWARE

A. Folding Door Hardware: ANS/BHMA A156.14; complete sets, including overhead rails, hangers, supports, bumpers, floor guides, and accessories indicated.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Hager Companies (HAG).
b. Johnson, L. E. Products, Inc. (LEJ).
c. Lawrence Brothers, Inc. (LB).
d. Pemko Manufacturing Company; an ASSA ABLOY Group Company (PEM).
e. Stanley Commercial Hardware; Division of Dorma-Kaba (STH).

B. Bi-folding Door Hardware: Rated for door panels weighing up to 50 lb (23 kg); Grade 1; with rails and door hardware that allow horizontal and vertical adjustment.

C. Multiple Folding Door Hardware: Rated for door panels weighing up to 50 lb (23 kg); Grade 1; with rails and door hardware that allows horizontal and vertical adjustment.

2.33 LOW-ENERGY DOOR OPERATORS FOR SWINGING DOORS

A. Low-Energy Door Operators: BHMA A156.19.

1. Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick; with manufacturer's standard machine or self-tapping screw fasteners.
2. Manufacturers:

a. Besam, Division of ASSA ABLOY Entrance Systems; SW200 Series.
b. LCN Closers, Division of Allegion Company (LCN); 9500 Series Senior Swing.
c. Record USA; 8100 Series.
d. Stanley Access (STH): M-Force Series

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf (67 N) required to release latch if provided, not more than 30 lbf (133 N) required to manually set door in motion, and not more than 15 lbf (67 N) required to fully open door.
2. Entrapment-Prevention Force: Not more than 15 lbf (67 N) required to prevent stopped door from closing or opening.

C. Configuration: Operator to control single swinging door or pair of swinging doors as indicated.

1. Traffic Pattern: Two way.
2. Operator Mounting: Surface.

D. Operation: Power opening and power-assisted spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

E. Microprocessor Control Unit: Solid-state controller.

F. Activation Device: Push-plate switch or touchless switch on each side of door to activate door operator.

2.34 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick ; with manufacturer's standard machine or self-tapping screw fasteners.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Manufacturers:

a. Burns Manufacturing Incorporated (BM); 50 Series.
b. Hager Companies (HAG); 190 Series.
c. IVES Hardware; an Allegion Company (IVE); 5200/5300 Series.
d. Rockwood Manufacturing Company (RM); RM1100 Series.

B. Armor Plates: 36 inches (914 mm) high by door width with allowance for frame stops.

C. Kick Plates: 12 inches (305 mm) high by door width with allowance for frame stops.

D. Mop Plates: 6 inches (152 mm) high by 1 inch (25 mm) less than door width.

E. Stretcher Plates: 8 inches (203 mm) high by door width with allowance for frame stops.

F. Mortise Angle Door Edging: 42 inches (1067 mm) high by minimum 0.050-inch- (1.3-mm-) thick metal sheet formed into angle shape; with 7/8-inch (22-mm) length of leg on face of door; for mortise application into edge of door.

G. Mortise Cap Door Edging: 42 inches (1067 mm) high by minimum 0.050-inch- (1.3-mm-) thick metal sheet formed into "U" shape; with 7/8-inch (22-mm) length of leg on faces of door; for mortise application into edge of door.

2.35 AUXILIARY DOOR HARDWARE

A. Auxiliary Door Hardware: ANSI/BHMA A156.16.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.

2.36 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware: ANSI/BHMA A156.35.

1. Basis of Design Product, Base Metal and Finish: As scheduled or indicated in Door Hardware Sets Schedule.
2. Electrified Functions: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
3. Concealed Plug Connectors: Termination of multi-wire bundles up to 8 conductors shall be by 8 position concealed plug connector or by 8 position and 4 position connectors for 12 wire applications.

B. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; listed and labeled for use with fire-alarm systems.

C. Door Position Switches: Magnetically operated reed switch designed for concealed mounting.

D. Door and Frame Transfer Devices: Steel housing for mortise in hinge stile of door, with flexible tube for wiring bundle; accommodating doors that swing open to 120 degrees.

2.37 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended; however, aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.

2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.38 FINISHES

A. Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

1. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

C. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.4 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated on Drawings and to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Custom Steel Doors and Frames: HMMA 831.
2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (760 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (760 mm) of door height greater than 90 inches (2286 mm).

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule and as directed by Owner.
2. Furnish permanent cores to Owner for installation.

F. Key Control System:

1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
2. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
3. Key Control System Software: Set up multiple-index system based on final keying schedule.

G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening or the least number of power supplies required to adequately serve doors with electrified door hardware.

H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Joint Sealants. Extend full width of opening and notch at door stops.

I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.5 FIELD QUALITY CONTROL

A. Contractor Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.6 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant is to examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.7 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service is to include 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

C. Continuing Maintenance Service Agreement: Prior to expiration of First Year Maintenance Service, installer shall furnish a proposal for Continuing Maintenance Service Agreement,

renewable yearly, including services, obligations, conditions, and terms for continuing maintenance service.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.10 DOOR HARDWARE SCHEDULE

A. Refer to Door Hardware Sets Schedule.

END OF SECTION

SECTION 088000
GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Glass, glazing, and supplementary items necessary for installation, including glass specified in other Sections where glazing requirements referenced to this Section.

1. Monolithic glass.
2. Laminated glass.
3. Insulating glass.
4. Decorative glazing.
5. Fire-protection-rated glazing.
6. Monolithic polycarbonate plastic glazing.
7. Bullet-resistive glazing.
8. One-way observation mirrored glazing.
9. Glazing sealants and glazing materials.

B. Enhanced Source Quality Control Standards: Comply with Manufacturer/Fabricator Enhanced Source Quality Control Standards for glass fabrication.

C. Related Requirements:

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Division 01 Section Laboratory Performance Mockup Testing for Building Enclosure System.
3. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.

1.2 ALTERNATES

A. Alternate for Heat Soaked Fully Tempered Glass: Where fully tempered glass is required due to structural loads and other performance requirements that cannot be met by increased glass thickness, using laminated glass or other means, provide heat soaked fully tempered glass in lieu of fully tempered glass.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.

2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:
   a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
   b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

B. Project Glazing Analysis: Prepared by manufacturer for primary glass or fabricator for fabricated glass units. Analyze each glass type and glazing condition for thermal, wind, impact and additional design loads indicated in glass performance requirements.
   1. Provide glass products in the thickness and strengths required to meet or exceed the criteria based on project loads and in-service conditions.

C. Delegated Engineering – Structural Glass and Other Applications Exceeding Project Glazing Analysis: Contractor shall employ a qualified structural engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.
   1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified structural engineer

1.5 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.
   1. Include manufacturer's specifications for materials, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.
   1. Include details of each type of glazing in conjunction with the appropriate framing system; indicate type of glass, sizes, shapes, glazing material, and quantity.
   2. Include details indicating glazing thickness, bite on glass, glass edge clearance, and depth of rabbet.

C. Glass Samples: For each type of glass product other than clear monolithic vision glass, 12 inches (300 mm) square.

D. Glass Range Sample Units: For each type of glass product other than clear monolithic vision glass, provide full size range samples representing anticipated range of appearance on the Project. Retain range samples for reference.

E. Glazing Accessory Samples: For gaskets, sealants and colored spacers, each type and color, in 12-inch (300-mm) lengths.

F. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer Project Acceptance Documents: Certifications by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1. Certification attesting application and use of glass for effects of thermal loading under expected service temperature ranges has been reviewed, and specified maximum probabilities of breakage will not be exceeded.

a. Certification shall include back pan and shadow box back pan conditions.

2. Certifications attesting performance for specified design wind load criteria, has been reviewed; furnish design factor, statistical probability of breakage and center deflection for the largest size of each thickness and type.
3. Certifications attesting face pressure of heat-strengthened glass units falls within limits specified. Glass determined to be outside these limits shall be replaced at no cost to Owner.
4. Insulated Glass Units: Certification from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.
5. Ceramic Frit Coated Glass: Certification from manufacturer acknowledging strength reduction of frit coating used on the Project.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include strength/deflection calculations and secondary sealant sightline analysis.

a. Provide thermal stress analysis and certification that heat strengthening or tempering complies with requirements and conditions indicated for this Project.

2. Where IGU structural performance based on inner/outer lite combination cannot be determined, fabricator shall assume outer lite only to meet structural requirements.

C. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

D. Source Quality Control Reports for Enhanced Quality Standards: When requested, provide written reports documenting testing procedures and recorded measurements. Include letter(s) certifying compliance for the following.

1. Distortion Tolerance Measurements: For heat-treated glass 6mm or thicker.
2. Insulating Glass Unit Fabrication and Testing Requirements: For insulating glass units.
3. Glass Color Tolerance Measurements: For monolithic coated glass and insulating coated glass units.

E. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

F. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

C. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
4. Certification: Qualified glazing contractor certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

D. Reflective- and Low-E-Coated Vision Glass: ASTM C1376, and as follows, whichever is more restrictive.

1. Inspection: At a distance of 10 ft (3 m), in transmission and reflectance at a viewing angle of 90° to the specimen, using a bright uniform background with diffused daylight conditions, without direct sunlight. Vision area shall extend to within 3 in (75 mm) of the perimeter of glass panel.
2. Reflectance and Transmission: Reflectance and transmission may vary slightly and be considered acceptable. Reflectance variations of plus or minus 1.5 percent are permissible.
3. Pinholes: Pinholes greater than 1/16 in (1.5 mm) diameter shall not be allowed within vision area.
4. Scratches: Scratches greater than 1/2 in (12 mm) shall not be allowed within vision area.

5. Verification of Color: Color shall be verified by using a Spectrophotometer placed directly on the specimen.

    a. Tolerance for Color Variance: ASTM C1376, Total Range (All Units, Each Glass Type) of less than or equal to 4.0 Delta E using CIEDE2000 as defined in ASTM D2244.

E. Reflective- and Low-E-Coated Spandrel Glass: ASTM C1376, Kind CS, and as follows, whichever is more restrictive.

1. Inspection: At a distance of 15 ft (4.6 m), a viewing angle of 90° to the specimen, using a bright uniform background with diffused daylight conditions, without direct sunlight.
2. Reflectance: Reflectance variations of plus or minus 1.5 percent are permissible.
3. Verification of Color: Color shall be verified by using a Spectrophotometer placed directly on the specimen.

    a. Tolerance for Color Variance: ASTM C1376, Total Range (All Units, Each Glass Type) of less than or equal to 4.0 Delta E using CIEDE2000 as defined in ASTM D2244.

F. Anisotropy Measurement: Anisotropy inspection is the measurement of polarized light calculated and presented as Maximum Iridescence or Total Stress in accordance with ASTM C1901-21.

1. Anisotropy shall be monitored using an on-line measurement system to assure that glass produced for this project measures within a consistent and accepted range of results established by baseline measurements on the accepted mockup glass.

    a. The intent of this requirement is to use measurements taken from mockup glass during the manufacturing process to establish an acceptable range of results as the baseline for the mass production of glass for this project.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 MOCKUPS

A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Provide glazing in mockups to match glazing systems required for Project, including glazing methods.

1.11 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.
f. Owners Building Enclosure Commissioning provider.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Insulating Glass Units: Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.13 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C),unless approved otherwise by manufacturer in writing.

1.14 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate glazing channel dimensions.

1. Provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
2. Achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.15 WARRANTY

A. Manufacturer Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

1. Coated Glass: Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

a. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

2. Laminated Glass: Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

a. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

3. Insulating Glass Units: Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

a. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

4. Heat-Soaked Tempered Glass: Breakage of heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period.

a. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

5. Polycarbonate Plastic Glazing: Deterioration of polycarbonate glazing is defined products that break or develop defects from normal use that are attributable to manufacturing process and not to practices for maintaining and cleaning plastic glazing contrary to manufacturer's written instructions. Defects include coating delamination, haze, excessive yellowing, and loss of light transmission beyond the limits stated in plastic glazing manufacturer's standard form.

a. Warranty Period: Manufacturer's standard but not less than 5 years after date of Substantial Completion.

B. Installer Warranty: Furnish installer written workmanship warranty signed by an authorized representative using installer standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. Defects □□is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Glass Selections: As scheduled or indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Failure includes but is not limited to the following:

a. Structural failures including but not limited to excessive deflection.
b. Glass breakage.
c. Failure of sealants or gaskets to remain watertight and airtight.
d. Deterioration of glazing materials.

B. Fire-Test-Response Characteristics of Plastic Glazing: As determined by testing plastic glazing by a qualified testing agency acceptable to authorities having jurisdiction.

1. Self-ignition temperature of 650 deg F (343 deg C) or higher when tested according to ASTM D1929 on plastic sheets in thicknesses indicated for the Work.
2. Smoke density of 75 or less when tested according to ASTM D2843 on plastic sheets in thicknesses indicated for the Work.
3. Flame-spread index of not less than that indicated when tested according to ASTM E84.

C. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Glazing to withstand each applicable design load case and load case combination within limits and under conditions determined in accordance with the IBC and ASTM E1300.

D. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads.

E. Exterior Glazing:

1. Design Wind Pressure: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.
3. Design Snow Loads: As indicated on Drawings.
4. Vertical Glazing: For glass surfaces set vertically 15 degrees or less from vertical, design glass to resist design loads based on glass type factors.
    a. Probability of Breakage for Vertical Glazing: For glass surfaces set vertically 15 degrees or less from vertical, design glass for a probability of breakage not greater than 0.008.
5. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist design loads and load combinations based on glass type factors
    a. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
6. Maximum Lateral Deflection: At design wind pressure.
    a. For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/100 times the short-side length or 1 inch (25 mm), whichever is less and keeps glazing retained in place with a suitable margin of safety under design conditions.
7. Thermal Loads: Design glazing to resist thermal stress breakage induced by conditions including differential shading within individual glass lites, temperatures and limited air circulation.
    a. Include back pan and shadow box back pan applications.
8. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone protection.
9. Safety Glazing: Where safety glazing is indicated or required, provide glazing that complies with 16 CFR 1201, Category II.
    a. Human Impact Loads: Locations indicated, and as defined by building code; glazed with safety glass.
10. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
    a. For monolithic glass lites, properties are based on units with lites 1/4 in (6 mm) thick.
    b. For laminated glass lites, properties are based on products of construction indicated.
    c. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
    d. U-Factors: Center-of-glazing values, according to NFRC 100, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
    e. Solar Heat-Gain Coefficient and Visible Light Transmittance: Center-of-glazing values, according to NFRC 200.
    f. Visible Reflectance: Center-of-glazing values, according to NFRC 300.
11. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

F. Interior Glazing:

1. Maximum Lateral Deflection: For glass supported on all four edges or two edges, limit center-of-glass deflection to not more than 1/100 times the short-side length or 1/2 in (12 mm), whichever is less, at 10 lb/sq ft (479 Pa) lateral load.
2. Differential Deflection: For glass installed to walking surfaces, deflection of adjacent unsupported edges shall not exceed glass thickness when subjected to 50 lbf/ft. (730 N/m) applied horizontally to one panel at any point up to 42 inches (1067 mm) above the adjacent walking surface.
3. Thermal Loads: Design glazing to resist thermal stress breakage induced by conditions including differential shading within individual glazing lites and temperatures.
4. Safety Glazing: Where safety glazing is indicated or required, provide glazing that complies with 16 CFR 1201, Category II.

   a. Human Impact Loads: Locations indicated, and as defined by building code; glazed with safety glass.

2.4 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA/GANA Publications: Glazing Manual and Laminated Glazing Reference Manual.
2. FGIA/AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. FGIA/IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. FGIA/IGMA Publication for Insulating Glass: IGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
5. FGIA/IGMA Publication Insulating Glazing Tolerances: IGMA TB-1200, "Guidelines for Insulating Glass Dimensional Tolerances."
6. FGIA/IGMA Publication for Thermal Stress: IGMA TM-1500, "Guidelines to Reduce Instances of Thermal Stress."
7. NGA/GANA Publications: "Guidelines for the Appearance of Insulating Glass Unit Edges in Commercial Applications at the Time of Installation

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1. Acceptable Products: Complying with CSPC 16 CFR 1201, Category II.

   a. Submit label location and size for Owner approval prior to fabrication. Glass having labels in locations not pre-approved shall be removed and replaced with glass having labels in the correct location at no cost to Owner.

2. Products Not Permitted: Wired Glass.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1. Units shall be certified by IGCC to comply with ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.

D. Insulating Glass Units: Acceptable products shall comply with the following:

1. ASTM E 546 Standard Test Method for Frost Point of Sealed Insulating Glass Units.
2. ASTM E 576 Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position.

E. Glass Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Exterior Glass Schedule: As indicated on Drawings, or as scheduled or as indicated in Design Selections.

a. Exterior Lites: Not less than 1/4 in (6 mm) minimum thickness.
b. Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

2. Interior Glass Schedule: As indicated on Drawings, or as scheduled or as indicated in Design Selections.

a. Interior Lites: Not less than 1/4 in (6 mm) minimum thickness.

F. Glass Strength: Provide Kind HS heat-strengthened float glass or Kind FT fully tempered float glass as required to comply with Performance Requirements, unless otherwise indicated:

1. Provide Kind HS (Heat Strengthened) at exterior conditions and where recommended by manufacturer to comply with performance requirements.
2. Provide Kind FT (Fully Tempered) as indicated and where recommended by manufacturer to comply with performance requirements or required for safety glazing.
3. Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with Performance Requirements.
4. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with Performance Requirements.
5. Where fully tempered float glass is indicated, provide fully tempered float glass.

a. Provide Kind FT fully tempered float glass where recommended by manufacturer to comply with safety glazing requirements.

2.5 GLASS PRODUCTS

A. Glass Manufacturers and Fabricators:

1. AGC Glass Co. North America, Inc.
2. Guardian Industries Corporation
3. Pilkington North America, Inc.
4. Vitro Architectural Glass (formerly PPG Industries, Inc.)
5. Saint Gobain.
6. Viracon.
7. Interpane.
8. Tecnoglass.
9. Oldcastle.

B. Clear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

C. Low-Iron Float Glass (Ultraclear): ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent.

1. Manufacturers and Products:

a. AGC Glass Co. North America, Inc.; Krystal Klear.

b. Guardian Industries Corp.; Ultrawhite.
c. Pilkington North America; Optiwhite.
d. Vitro Architectural Glass (PPG Industries, Inc.); Starphire.

D. Tinted Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

E. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented after completion of field glazing unless Architect's advanced written approval is provided otherwise.

F. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented after completion of field glazing unless Architect's advanced written approval is provided otherwise.

G. Heat Soaking Tempered Glass: Provide heat soak testing for fully tempered products in accordance with EN 14179-1 or EN 14179-2 and manufacturer's recommended heat soak testing process.

1. Locations Schedule:

a. As scheduled or indicated in Design Selections or Drawings.
b. As indicated in Alternate for Heat Soaked Fully Tempered Glass.
c. Locations recommended by manufacturer.

H. Reflective- and Low-E-Coated Vision Glass: ASTM C 1376, coated by pyrolytic process or vacuum deposition (sputter-coating) process, standard of manufacturer, and complying with other requirements as specified.

1. Kind: Kind CV (coated vision glass), except that Kind CO (coated overhead glass) may be used where the lower edge of the glass is more than 6 ft (1.8 m) above the adjacent floor level or cannot be approached closer than 10 ft (3 m).

I. Ceramic-Coated Vision Glass: ASTM C 1048, Condition C, Type 1, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3, heat-treated float glass with ceramic enamel; complying with Specification No. 95-1-31 in NGA/GANA's "Engineering Standards Manual", and with other requirements as specified.

J. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and with other requirements as specified.

K. Reflective- and Low-E-Coated Spandrel Glass: ASTM C 1376, Kind CS; coated by pyrolytic process or vacuum deposition (sputter-coating) process, standard of manufacturer, and complying with other requirements as specified.

L. Bent Glass: ASTM C1464, kind, glass type, bend, and other properties as indicated.

1. Manufacturers and Fabricators:

a. Interpane.
b. Cristacurva.
c. SBG Standard Bent Glass.

M. Patterned Glass: ASTM C 1036, Type II (patterned and wired glass, flat), Class 1 (clear), Form 3 (patterned), Quality-Q6, Finish F1 (patterned one side), unless otherwise indicated.

N. Tempered Patterned Glass: ASTM C 1048, Kind FT (fully tempered), Type II (patterned glass, flat), Class 1 (clear), Form 3 (patterned), Quality-Q6, Finish F1 (patterned one side), unless otherwise indicated.

O. Decorative Film Overlay: Translucent, dimensionally stable, film, 2-mil- (0.05-mm-) minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

1. Selections: As scheduled or indicated in Design Selections.

2.6 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Comply with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral (PVB) interlayer or SGP Ionoplast interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than indicated and as needed to comply with requirements.

a. Minimum Thickness: 0.030 in (0.75 mm) unless otherwise indicated.
b. Sloped Glazing: 0.030 in (0.75 mm) to 0.060 in (1.5 mm); as needed to comply with performance requirements.
c. Wind Borne Debris Impact Resistance: 0.060 in (1.5 mm) to 0.090 in (2.2 mm); as needed to comply with performance requirements.
d. Heat Strengthened and Fully Tempered Glazing: 0.060 in (1.5 mm) minimum.

3. Interlayer Color: Clear unless otherwise indicated.
4. Typical Interlayer - Manufacturers and Products:

a. DuPont; Butacite.
b. Eastman Chemical Company; Saflex.
c. Kuraray; SentryGlas.

5. Glass Railing / Windscreen Interlayer - Manufacturers and Products:

a. Basis of Design: Kuraray America Inc.; SentryGlas Ionoplast.

B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified for laminated glass using the following to comply with interlayer manufacturer's written instructions. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with one of the following to comply with interlayer manufacturer's written recommendations:

a. Polyvinyl butyral interlayer.
b. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
c. Ionoplast interlayer.
d. Cast-in-place and cured-transparent-resin interlayer.
e. Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.

2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.

3. Interlayer Color: Clear unless otherwise indicated.

2.7 INSULATING GLASS

A. Insulating Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and in compliance with other specified requirements.

1. Insulating Glass Unit Thickness Tolerance: Minus 1/16 inch, plus 1/32 inch.

a. Units Constructed with Patterned or Laminated Glass: Plus or minus 1/16 inch.

2. Sealing System: Dual seal, with polyisobutylene primary seal and silicone secondary seal in accordance with ASTM C 1249. Provide insulating glass units free of skips or voids in the primary or secondary seals.

a. Primary IGU Seal: Primary IGU sealant shall be fully wetted against glass, applied in a continuous, uninterrupted, properly dimensioned bead with no skips or voids around perimeter, each side of IGU.

1) Primary Seal Width: 5/32-inch.
2) Primary Seal Thickness: 1/16-inch minimum thickness after pressing IGU.
3) Air Spacer Visibility: 3/32-inch maximum visible exposure beyond polyisobutylene primary seal.

b. Secondary IGU Seal: Secondary IGU sealant shall be fully wetted against glass and spacer, applied in a continuous, uninterrupted, properly dimensioned bead, filling cavity with sealant completely.

1) Secondary Seal Thickness: As determined by glass manufacturer; meeting minimum design width and depth requirements as determined by glass strength and deflections, plus 1/16-inch tolerance.
2) Corners: IGU corners shall be completely filled with secondary sealant.

c. Skips and Voids Between Primary and Secondary Sealant: Maximum of 2-inches long by 1/16-inch-wide discontinuity separated by at least 18-inches. Provide continuous contact between primary and secondary IGU sealant, cleanly tool secondary sealant prior to packing.

d. Sealant Color: Black, unless otherwise scheduled or indicated in Design Selections.

3. Spacer: Provide a hermetically sealed and dehydrated space; lites shall be separated by a spacer with three bent corners and one keyed-soldered corner or four bent corners and one straight butyl injected zinc plated steel straight key joint.

a. Spacer Material and Color:

1) Spacer Material and Color: Aluminum with mill or clear anodic finish, unless otherwise scheduled or indicated in Design Selections.

b. Spacer Material and Color:

1) Division 8 Section Glazed Aluminum Framing Systems: Aluminum, black color, unless otherwise scheduled or indicated in Design Selections.
2) Division 8 Section Structural Glass Curtainwall System: Stainless Steel, unless otherwise scheduled or indicated in Design Selections.

4. Edge Deletion: Delete coating at perimeter of coated lite prior to fabrication of insulating glass units according to coated glass manufacturer’s instructions.
5. Desiccant: Molecular sieve or silica gel, or blend of both.

2.8 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and complies with NFPA 80.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label indicates manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F (250 deg C) temperature-rise limitation; and fire-resistance rating in minutes.

C. Monolithic Fire-Protection-Rated Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch (5-mm) thickness; complying with 16 CFR 1201, Category II.

1. Manufacturers and Products:

a. Technical Glass Products; FireLite.
b. Safti First; SuperLite.
c. Schott North America, Inc.; Pyran Star.
d. Vetrotech; Keralite.

2. Basis of Design: Technical Glass Products; FireLite.

a. Locations - Safety Glazing not Required: Where indicated or scheduled for 20, 45, 60, and 90-minute ratings.

D. Fire-Protection-Rated Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; complying with 16 CFR 1201, Category II.

1. Manufacturers and Products:

a. Technical Glass Products; FireLite Plus (Laminated).
b. Safti First; SuperLite (Laminated).
c. Schott North America, Inc.; Pyran Star (Laminated).
d. Vetrotech Saint-Gobain; Keralite (Laminated).

2. Basis of Design: Technical Glass Products; FireLite Plus.

a. Locations - Safety Glazing Required: Where indicated or scheduled for 20, 45-, 60-, 90-, and 120-minute ratings.

2.9 INTERIOR PLASTIC GLAZING

A. Glazing Publication: Comply with published instructions of plastic glazing manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated. See this publication for definitions of glazing terms not otherwise defined in this Section or in other referenced standards.

B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.

C. Sizes: Fabricate plastic glazing to sizes required for openings indicated. Allow for thermal expansion and contraction of plastic glazing without restraint and without withdrawal of edges from frames, with edge clearances and tolerances complying with plastic glazing manufacturer's written instructions.

D. Monolithic Polycarbonate Glazing: Polycarbonate sheet; ASTM C 1349, Appendix X1, Type I (standard, UV stabilized), with a polished finish.

1. Manufacturers and Products:
   a. Altuglas International, Division of Arkema Inc.; Tuffak XL.
   b. Amerilux International, LLC; Coverlite Solid Polycarbonate.
   c. General Electric Company; Lexan XL-1.
   d. Palram Americas; Palsun.
   e. Sheffield Plastics Inc., a Bayer Material Science Company; Makrolon SL.
2. Nominal Thickness: 0.236 in (6 mm) unless indicated otherwise.
3. Color: Transparent colorless
4. Flame-Spread Index: 25 or less.

2.10 BULLET-RESISTIVE GLAZING

A. Refer to Division 08 Section Security Windows.

2.11 ONE-WAY OBSERVATION MIRRORED GLAZING

A. Laminated One-Way Observation Mirrored Glazing: Manufactured by vacuum depositing extremely thin layers of metal, selected for high reflectance and durability, onto one surface of tempered glass by a process of magnetically sputtered vacuum deposition.
   1. Manufacturer and Product: Pilkington; Mirropane.
   2. Thickness: 1/4 inch (6 mm) minimum thickness, or as recommended by manufacturer.

2.12 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. EPDM (peroxide cured) complying with ASTM C 864.
   2. Silicone complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded closed-cell, integral-skinned gaskets of EPDM, silicone, or thermoplastic polyolefin rubber, complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal and compatible with sealants.
   1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
      a. Gasket Color: Black, unless otherwise scheduled or indicated in Design Selections. Gaskets concealed from view may be black.

C. Provide factory pre-molded, vulcanized or heat welded corners, for continuous, joint-free glazing material around sides of the glazing rabbet. Field-cut corners not allowed.

D. Provide gasket slightly longer than opening to be filled, as recommended by gasket manufacturer.

2.13 GLAZING SEALANTS

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Additional Movement Capability: Provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers and Products:

a. Dow; DOWSIL 795 Silicone Building Sealant.
b. GE Construction Sealants; Momentive Performance Materials Inc.GE Advanced Materials - Silicones; Silglaze II.
c. Pecora Corporation; 895.
d. Sika Corp.; Sikasil WS-295.

2. Color: As selected by Architect from manufacturer's full range of colors.

C. Structural-Glazing Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated, and tested for use as structural-sealant and approved by structural-sealant manufacturer for use in glazed aluminum wall assembly indicated.

1. Minimum Tensile Strength: 100 psi (690 kPa).
2. Modulus of Elasticity: As required by structural-sealant-glazed aluminum wall system design to meet performance requirements.
3. Manufacturers and Products: Subject to compliance with requirements, provide one of the following:

a. Dow; DOWSIL 983 Structural Glazing Sealant.
b. GE Construction Sealants; Momentive Performance Materials Inc.GE Silicones; SSG4400 Ultraglaze Sealant.
c. Tremco Incorporated; Proglaze SSG.

4. Color: Black, unless otherwise scheduled or indicated in Design Selections Summary.

D. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

2.14 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape is for high-performance commercial glazing applications involving continuous pressure from gaskets or pressure-generating stop designs. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.15 ENGINEERED TRANSITION ASSEMBLIES

A. Engineered Transition Assembly: Provide engineered transition assembly to seal air barrier perimeter to windows, doors and glazed aluminum framing systems.

1. Basis of Design: Tremco, Inc; Proglaze Engineered Transition Assembly (ETA).

B. Pre-Engineered Aluminum and Silicone Materials: Mechanically attach system assembly to glazed aluminum framing systems and provide durable seal. Engineered transitions assembly includes the following components:

1. Silicone Rubber Sheet (SRS): Extruded, 40 durometer, translucent silicone, with lock-in rubber dart.
2. Silicone Rubber Corners (SRC): Pre-molded, 40 durometer, translucent silicone, with lock in rubber dart
3. Silicone Sealants: Comply with ASTM C 920, single-component, neutral-curing silicone; Class 100/50, Grade NS, Use O.

   a. Basis of Design: Tremco Inc.; Spectrem 1, or another approved sealant as recommended by manufacturer.

4. Extruded Aluminum Attachment (EAA): Alodine finished, pre-engineered profile designed to receive silicone lock-in rubber dart. Pre-drilled extrusion with butyl tape, 100% solid polyisobutylene-cross linked butyl preformed sealant.

2.16 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Silicone material with a Shore, Type A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Silicone blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Silicone material of hardness needed to limit glass lateral movement (side walking).
2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.17 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

B. Butt Glazing: Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.18 DECORATIVE GLASS FABRICATION

A. Fabricate decorative glass and provide other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with product manufacturer's written instructions and with referenced glazing standard.

B. Edge Finishing: Finish edges smooth and polished, without chips, scratches, or warps.

2.19 SOURCE QUALITY CONTROL

A. Inspections and Testing: Manufacturer/fabricator shall perform pre-construction source quality-control inspections and testing, including but not limited to the following.

1. Basis of Design for Enhanced Quality Control Standard: Guardian Elite Optical Quality Standards or equivalent enhanced fabrication standard as recommended by glass manufacturer/fabricator and accepted by the Architect to meet the design intent for the Project.
2. Certification: Certifications by the manufacturer/fabricator that its products and systems comply with requirements and that products failing to meet requirements are not incorporated into the Work.
3. Documentation: Inspection and testing records shall be maintained for a period of 10 years from the date of Substantial Completion. Provide inspection and testing records upon request and at no cost to Owner or Architect.
4. Visual Mockup Glass:

a. Measurements reviewed and approved for glass panels used in mockups shall establish fabrication tolerances for the Project.
b. Glass panels used in visual mockups shall be fabricated to the same fabrication tolerances as glass panels to be used on the Project.

B. Distortion Tolerance Measurement for Processing Heat-Treated Glass.

1. On-Line Distortion Measurement System: Measure each piece of monolithic, uncoated or coated, heat-treated glass 6 mm or thicker.
2. Roll Wave and Optical Distortion Limits (mD): On-Line Measurement.

a. Roll Wave Distortion Limits: Maximum peak-to-valley roll wave of 0.003 inch (0.08 mm) in the central area of the glass lite, and 0.008 inch (0.20 mm) within 12 inches (305 mm) of the leading and trailing edge of the lite, measured in accordance with ASTM C 1651 – Standard Test Method for Measurement of Roll Wave Optical Distortion in Heat-Treated Float Glass.
b. Center Kink Distortion Limits: Maximum center-kink of 0.001 inch (0.025 mm) roll wave measured over the surface of the glass perpendicular to the direction of travel through the heat treatment furnace.
c. Optical Distortion Limits - Millidiopter (mD) Measurements for Clear or Low-Iron Glass 1/4-Inch (6 mm) to 3/8-Inch (10 mm) Thickness, No Ceramic Frit or Ink: Maximum distortion of plus or minus 100 mD over 95% of the glass surface area, measured in accordance with ASTM C 1652 - Standard Test Method for Measuring Optical Distortion in Flat Glass Products Using Digital Photography Grids.
d. Measurement Equipment: On-Line measurement system utilizing high resolution optics measured in diopters.

1) Basis of Design: LiteSentry; Osprey (Version 7 or Higher) Online Distortion Measurement System.

e. Exclusions: Silk screen, full coverage ceramic frit glass and glass panels 10 mm and thicker are excluded from this requirement.

3. Bow/Warp (Concave/Convex) Distortion Limits: Off-Line Straight Edge Measurement.

a. Localized and Overall Bow (Warp) Distortion: Localized and overall bow (warp) per lite shall not exceed one-half of the maximum allowed by ASTM C 1048. Localized warp shall not exceed 1/32 in (0.8 mm) over any 12” span (30mm).

C. Enhanced Insulating Glass Unit Fabrication and Testing Requirements.

1. Sealant Uniformity: Perform IGMA Sealant Uniformity of Mix Test not less than once per shift. Submit test reports upon Architect's request.
2. Primary Seal - Sealant Adhesion Testing: Manufacturer recommended IGU adhesion pull testing process on units fabricated at the same time of production and on the same production line using the same processing equipment to produce this Project. Conduct testing each shift or carton change on units not less than 24 in (600 mm) x 24 in (600 mm).

a. Adhesion Criteria: Comply with pass/fail requirements of manufacturer published guidelines and/or manufacturer certification requirements.

3. Residual Moisture Content: Perform IGMA Residual Moisture Content by Head of Absorption Test. Perform test in accordance with desiccant manufacturer’s written recommendations. Submit test reports upon Architect's request.
4. Bow/Warp Unit Distortion Tolerance (Concave/Convex): Off-Line Straight Edge Measurement.

a. Localized and Overall Bow (Warp) Distortion: Localized and overall bow (warp) per lite shall not exceed one-half of the maximum allowed by ASTM C 1048. Localized warp shall not exceed 1/32 in (0.8 mm) over any 12” span (30mm).
b. Air Space Gap Measurement: Visually inspect all units and measure center air space gap on all finished units over 35 square feet.

1) Air Space Gap Tolerance: Maximum plus or minus 1/16 in (1.5 mm) at time of fabrication.

5. Sealant Application: No skips/voids in primary or secondary seal. Secondary seal cleaned/tooled prior to packing; no sealant smears on glass surfaces.
6. Coating Edge Deletion: Clean, straight and precise.

a. Coating Edge Deletion Tolerance: Uniformly remove coating to the greater of 3/8 in (10 mm) from the edge of glass to the edge of the coating, or at least 50% through the primary seal width to the edge of glass.

7. Spacers: Metal, bent.

a. Spacer connections shall be sealed to ensure IGU is hermetically sealed.

D. Glass Color:

1. General: Based on the established color target for each type of glass product, perform quality color control checks using on-line and off-line measurement spectrophotometer instrumentation to ensure compliance with ASTM C1376. Measure each piece of the following glass types:

a. Monolithic coated glass.
b. Insulating glass units.

2. Anisotropy (Iridescence): Perform anisotropy (iridescence) scan utilizing detection system approved by glass manufacturer. Perform test in accordance with detection system manufacturer's written instructions. Continuously monitor production and record results. Maintain results for a period of not less than 10 years.
3. Color Variation of Glass Coatings: Provide vacuum deposition coatings on glass complying with color variation limits specified in ASTM C 1376. Perform color monitoring utilizing spectrophotometer equipment approved by glass manufacturer. Perform test in accordance with manufacturer's approved procedure. Test finished insulated glass units in accordance with reflected color specifications and in comparison, to approved mockup control sample. Statistically monitor production and record results. Maintain results for a period of not less than 10 years.
   a. Tolerance for Color Variance: ASTM C1376, Total Range (All Units, Each Glass Type) of less than or equal to 4.0 Delta E using CIEDE2000 as defined in ASTM D2244.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
   1. Respective manufacturer's written installation instructions.
   2. Accepted submittals.
   3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

C. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.4 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 in (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8 in (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. One-Way Observation Mirrored Glazing: Install with reflective surface facing the brightly lit subject-side.

3.5 INSTALLATION OF DECORATIVE GLAZING

A. Set decorative glass units in each series true in line with uniform orientation, pattern, draw, bow, and similar characteristics.

B. Set decorative glass in locations indicated on Drawings. Install glass with hardware and accessories according to hardware manufacturer's written instructions. Attach hardware securely to mounting surfaces.

3.6 TAPE GLAZING FOR INTERIOR INSTALLATIONS

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.7 GASKET GLAZING (DRY)

A. Fabricate compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.8 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.9 FIELD QUALITY CONTROL

A. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control.

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Division 01 Building Enclosure Commissioning for Field Observations and Performance Testing.
3. Glass Color Tolerances: Owner testing agency may perform onsite color measurements using spectrophotometer instrumentation to ensure compliance with Tolerances for Color Variation.

a. Onsite Developed Reference Target: Onsite developed reference target shall be the average measurement of not less than 75% of glass units of the same glass type per façade.

1) Tolerance for Color Variance: ASTM C1376, Total Range (All Units, Each Glass Type) of less than or equal to 4.0 Delta E using CIEDE2000 as defined in ASTM D2244.

b. Testing agency will prepare survey report indicating locations not complying with specified tolerances.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.10 CLEANING AND PROTECTION

A. Immediately after installation, remove non-permanent labels and clean surfaces.

B. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

C. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

1. Coordinate glass cleaning schedule with Owner's requirements.

3.11 GLASS TYPE SCHEDULE

A. Exterior Glass Schedule: (Note: Provide FT glass where required for safety glazing.)

1. GL01: Insulating Coated Glass - Vision

a. Overall Thickness: 1 in (25 mm) nominal.
b. Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
c. Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
d. Air Space: 1/2 in (12 mm); [Aluminum][Stainless Steel], [Mill Finish][Black], [Air][Argon].
e. Inboard Lite: Clear HS; 1/4 in (6 mm) thick glass.
f. Basis of Design Manufacturer and Product:
g. Remarks: Sealants and Gaskets to be Black color unless indicated otherwise.
h. Performance Requirements:

1) Visible Light Transmittance:
2) Exterior (Vis-Out) Reflectance:
3) Winter U-Value:
4) Summer U-Value:
5) Shading Coefficient:
6) Solar Heat Gain Coefficient:
7) Light to Solar Gain Ratio:

2. GL02: Insulating Coated Glass, Ceramic-Coated - Vision

a. Overall Thickness: 1 in (25 mm) nominal.
b. Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.

1) Silk-Screened Ceramic Frit: [Color][Pattern; eg: Pattern of alternating 10 mm horizontal color bands and 10 mm open bands starting at the top with a line on No. 2 surface].
2) Digital Image Ceramic Ink: Custom digital image applied to glass and heat-fused to glass.

c. Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
d. Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
e. Inboard Lite: Clear HS; 1/4 in (6 mm) thick glass.
f. Basis of Design Manufacturer and Product:

3. GL03: Insulating Coated Glass - Vision with Shadow Box Back Panel

a. Overall Thickness: 1 in (25 mm) nominal.
b. Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
c. Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
d. Inboard Lite: Clear HS; 1/4 in (6 mm) thick glass.
e. Shadow Box Back Panel: Aluminum, 2 mm thick with pre-finished color: [List Color]
f. Basis of Design Manufacturer and Product:

4. GL04: Insulating Glass - Vision at Lobby (Low Iron)

a. Overall Thickness: 1 in (25 mm) nominal.
b. Outboard Lite: Clear, Low Iron FT; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
c. Air Space: 1/2 in (12 mm); Grey spacer; Grey sealant.
d. Inboard Lite: Clear, Low Iron FT; 1/4 in (6 mm) thick glass.

e. Basis of Design Manufacturer and Product:
f. Remarks: Sealants and Gaskets to be Grey color unless indicated otherwise.

5. GL05: Insulating Laminated Coated Glass - Vision [Wind Borne Debris Impact Resistant, Large Missile Impact][Wind Borne Debris Impact Resistant, Small Missile Impact][Blast-Resistant][Skylight]

a. Overall Thickness: As required by design.
b. Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
c. Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
d. Inboard Lite: Two plies Clear HS; 1/4 in (6 mm) thick glass; laminated.
e. Interlayer: [PVB][SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in. (2.50 mm)].
f. Basis of Design Manufacturer and Product:

6. GL06: Laminated Insulating Coated Glass - Vision [Wind Borne Debris Impact Resistant][Blast-Resistant][Skylight]

a. Overall Thickness: As required by design.
b. Outboard Lite: Two plies Clear HS; 1/4 in (6 mm) thick glass; laminated.
c. Interlayer: [PVB][SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in. (2.50 mm)].
d. Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
e. Inboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 4 surface.
f. Basis of Design Manufacturer and Product:

7. GL07: Insulating Laminated Coated Glass - Acoustical Vision

a. Overall Thickness: 1.5 in. (38mm), STC 45.
b. Outboard Lite: Two plies Clear HS; 1/4 in (6 mm) thick glass; laminated with coating on No. 2 surface. Interlayer: 0.60 in PVB.
c. Air Space: 3/4 in (19 mm); Black spacer; Black sealant.
d. Inboard Lite: Two plies Clear HS; 1/8 in (3 mm) thick glass; laminated.
e. Interlayer: [PVB][SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in. (2.50 mm)].
f. Basis of Design Manufacturer and Product:

8. GL08: Laminated Coated Glass - Vision

a. Overall Thickness: As required by design.
b. Outboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass with coating on No. 2 surface.
c. Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
d. Interlayer: [PVB][SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in. (2.50 mm)].
e. Basis of Design Manufacturer and Product:

9. GL09: Laminated Glass - Vision

a. Overall Thickness: As required by design.
b. Outboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
c. Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.

d. Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in. (2.50 mm)].
e. Basis of Design Manufacturer and Product:

10. GL10: Laminated Glass, Ceramic-Coated - Canopy

a. Overall Thickness: As required by design.
b. Upper Lite: Clear HS; 3/8 in (10 mm) minimum thick glass with ceramic frit on the No. 2 surface.

1) Silk-Screened Ceramic Frit: [Color][Pattern; eg: Pattern of alternating 10 mm horizontal color bands and 10 mm open bands starting at the top with a line on No. 2 surface].
2) Digital Image Ceramic Ink: Custom digital image applied to glass and heat-fused to glass.

c. Lower Lite: Clear HS; 3/8 in (10 mm) minimum thick glass.
d. Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in. (2.50 mm)].
e. Basis of Design Manufacturer and Product:

11. GL11: Laminated Glass, Ceramic-Coated - Guardrail

a. Overall Thickness: As required by design.
b. Outboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass with ceramic frit.

1) Silk-Screened Ceramic Frit: [Color][Pattern; eg: Pattern of alternating 10 mm horizontal color bands and 10 mm open bands starting at the top with a line on No. 2 surface].
2) Digital Image Ceramic Ink: Custom digital image applied to glass and heat-fused to glass.

c. Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
d. Interlayer - Basis of Design: SentryGlas Ionoplast; Clear, thickness as required for intended use.
e. Basis of Design Manufacturer and Product:

12. GL12: Laminated Glass - Guardrail

a. Overall Thickness: As required by design.
b. Outboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
c. Inboard Lite: Clear HS; 1/4 in (6 mm) minimum thick glass.
d. Interlayer - Basis of Design: SentryGlas Ionoplast; Clear, thickness as required for intended use.
e. Basis of Design Manufacturer and Product:

13. GL13: Monolithic Coated Glass

a. Overall Thickness: 1/4 in (6 mm) nominal.
b. Monolithic Lite: Clear; 1/4 in (6 mm)) thick glass with coating on No. 2 surface.
c. Basis of Design Manufacturer and Product:

14. GL14: Monolithic Glass - All Glass Doors and Vestibules

a. Lite: Clear FT; 3/4 in (19 mm) minimum thick glass.

15. GL15: Insulating Coated Glass, Ceramic-Coated - Spandrel

a. Overall Thickness: 1 in (25 mm) nominal.

b. Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
c. Air Space: 1/2 in (12 mm); Black sealant.
d. Inboard Lite: Clear HS; 1/4 in (6 mm) thick glass with ceramic frit on No. 4 surface.

1) Silk-Screened Ceramic Frit: [Color].
2) Digital Image Ceramic Ink: Custom digital image applied to glass and heat-fused to glass.

e. Basis of Design Manufacturer and Product:

16. GL16: Insulating Laminated Coated Glass - Spandrel [Wind Borne Debris Impact-Resistant][Blast-Resistant][Skylight]

a. Overall Thickness: As required by design.
b. Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with coating on No. 2 surface.
c. Air Space: 1/2 in (12 mm); Black spacer; Black sealant.
d. Inboard Lite: Two plies Clear HS; 1/4 in (6 mm) thick glass; laminated.
e. Interlayer: [PVB][Dupont SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in. (2.50 mm)].
f. Basis of Design Manufacturer and Product:

17. GL17: Monolithic Glass - Spandrel

a. Overall Thickness: 1/4 in (6 mm) nominal.
b. Monolithic Lite: Clear HS; 1/4 in (6 mm)) thick glass with [Color] ceramic frit on No. 2 surface.
c. Basis of Design Manufacturer and Product:

B. Interior Glass Schedule: (Note: Provide FT glass where required for safety glazing.)

1. GL101: 1/4 in (6 mm) thick clear float glass.
2. GL102: 1/4 in (6 mm) thick fully tempered clear glass.
3. GL103: 1/4 in (6 mm) thick wire glass.
4. GL104: Laminated glass - Vision.

a. Overall Thickness: As required by design.
b. Outboard Lite: Clear float, 1/4 in (6 mm) minimum thick glass.
c. Inboard Lite: Clear float; 1/4 in (6 mm) minimum thick glass.
d. Interlayer: [PVB][SentryGlas Ionoplast], [Clear][Color], [thickness as required for intended use][0.030 in (0.75 mm).][0.060 in (1.5 mm).][0.090 in (2.25 mm).][.100 in. (2.50 mm)].

5. GL105: Patterned Glass

a. Thickness: 1/4 in (6 mm)
b. Description:
c. Basis of Design Manufacturer and Product:

6. GL106: Bullet-Resistive Glass

a. Thickness:
b. Description:
c. Basis of Design Manufacturer and Product:

7. GL107: Fire Rated Glass

a. Thickness:
b. Description:

c. Basis of Design Manufacturer and Product:

8. GL108: Transparent Mirror

a. Thickness: 1/4 in (6 mm)
b. Color: [Clear][Grey]
c. Basis of Design Manufacturer and Product: Interpane; MirroVue.

9. GL109: Decorative Glass

a. Basis of Design Manufacturer and Product:
b. Pattern:

3.12 GLAZING SCHEDULE

A. Tape Glazing:

1. Interior door glass lites.
2. Interior borrowed lights less than 75 united inches.

B. Sealant and Tape Glazing:

1. Exterior door glass lites.
2. Interior borrowed lights greater than 75 united inches.

C. Compression Gasket Glazing:

1. Curtain and window walls
2. Interior store fronts
3. Skylights
4. Sloped glazing
5. Fixed aluminum windows

D. Structural Silicone Glazing: Where indicated on drawings.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 089100
WALL LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fixed wall louvers and supplementary items necessary for installation.

B. Related Requirements:

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

1.2 DEFINITIONS

A. BSRIA: Building Services Research and Information Association.

B. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

C. Standard Free Area: Free area of a louver 48 in (1200 mm) wide by 48 in (1200 mm) high, identical to that provided.

D. Maximum Standard Airflow: Airflow at point of beginning water penetration through a louver 48 in (1200 mm) wide by 48 in (1200 mm) high, identical to that provided.

E. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

F. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.

G. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

H. Storm-Resistant (Wind-Driven-Rain-Resistant) Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

I. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing according to AMCA 540, and AMCA 550 where louvers provide wind driven rain resistance at air intake openings.

J. Sand-Resistant Louver: Louver that meets specified sand-trap criteria, as determined by BSRIA Standard EN 13181 or ASHRAE Standard 52-76.

K. FEMA Extreme Weather Louver: Louver that meets wind-born debris as determined by FEMA P-361, ICC 500 and ASTM 330.

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in

providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:
   a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
   b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include typical unit elevations at 1/2 in (12 mm) scale and details at full scale.
2. Show frame profiles and blade profiles, angles, and spacing.
3. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
4. Show mullion profiles and locations.
5. Indicate where and how the system deviates from Contract Documents.
6. Shop drawings shall contain seal of a professional engineer currently registered in licensing jurisdiction of the project and a written statement that the framing system conforms to project requirements, applicable codes, and specified conditions.
7. Provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, or, and sealed by a professional engineer licensed to practice in the jurisdiction where the project is located.
8. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

C. Samples for Verification Purposes: Of each type of metal finish required, prepared on Samples of same thickness and material indicated for final Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
2. Product Approvals: Submit Florida Product Approval or Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

E. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Welding: Qualify procedures and personnel according to the following:

1. Aluminum Louvers: AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".
2. Galvanized Steel Louvers: AWS D1.3, "Structural Welding Code - Sheet Steel".

D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Factory Applied Finish Warranty for Fluoropolymer Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Coverage includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 20 years from date of Substantial Completion.

B. Factory Applied Finish Warranty for Anodic Finishes: Furnish manufacturer's written warranty signed by an authorized representative using manufacturer's standard form agreeing to repair finish or replace work which exhibits finish defects. "Defects" is defined to include but not limited to deterioration or failure of finish to perform as required.

1. Warranty Period: Manufacturer shall warrant the installation to be free from finish defects for a period of 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Air Flow Company, Inc.
2. Airolite Company, LLC.
3. American Warming and Ventilating, Inc.; a Mestek company.
4. Arrow United Industries; a division of Mestek, Inc.
5. Construction Specialties, Inc. (C/S Group).
6. Greenheck Fan Corporation.
7. Industrial Louvers, Inc.
8. Nystrom Building Products (Airline Louvers).
9. Ruskin Company.
10. Safe-Air Dowco.

11. United Enertech.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Failure includes the following:

a. Noise or vibration created by wind and thermal and structural movements.
b. Loosening or weakening of fasteners, attachments, and other components.

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:

1. Live Load Deflection: Accommodate differential vertical deflection of floors:

a. Deflection: As indicated on Drawings.

2. Inter-story Drift: Accommodate inter-story drift between adjacent floors perpendicular and/or parallel to the wall:

a. Design Displacement: As indicated on Drawings.

D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

E. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

F. Windborne-Debris-Impact-Resistance: Comply with impact resistance testing requirements for Wind Zone, when tested according to AMCA 540, and AMCA 550 where louvers provide wind driven rain resistance at air intake openings.

G. Sand-Resistance Requirements: Engineer to reject passage of sand when tested according to specified Standards.

H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance.
   a. Fabrication, assembly and erection procedures shall take into consideration the ambient temperature range at the time of each operation.

I. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 MATERIALS

A. Aluminum Extrusions: ASTM B 221 / B 221M, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209 / B 209M, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26 / B 26M, Alloy 319.

D. Galvanized-Steel Sheet: ASTM A 653 / A 653M, G90 (Z275) zinc coating, mill phosphatized.

E. Fasteners: Use types and sizes to suit unit installation conditions. For color-finished louvers, use fasteners with heads that match color of louvers.

1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
2. Aluminum Louvers: For fastening aluminum, use 300 series stainless-steel fasteners.
3. Galvanized Steel Louvers: For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.

F. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Where indicated, fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
2. Horizontal Mullions: Where indicated, provide horizontal mullions at joints unless continuous vertical assemblies are indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel, unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacing indicated, but not more than recommended by manufacturer, or 72 in (1800 mm) on center, whichever is less.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
2. Semi-recessed Mullions: Where indicated, provide mullions partly recessed behind louver blades so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
3. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
4. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with semi-recessed mullions at corners.

G. Provide subsills and extended sills made of same material as louvers where required for drainage to exterior and to prevent water penetrating to interior.

H. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Storm-Resistant (Wind-Driven-Rain-Resistant) Louvers - Exposed Mullions:

1. Basis of Design: Construction Specialties Model RSH-5700.
2. Louver Depth: 5 in (127 mm), unless otherwise indicated.
3. Frame and Blade Nominal Thickness: As required by the engineered design.
4. Louver Performance Ratings:

a. Free Area: Not less than 7.32 sf (0.68 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 in (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a maximum core-area intake velocity of 779 fpm (4.0 m/s).

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

B. Horizontal, Storm-Resistant (Wind-Driven-Rain-Resistant) Louvers - Semi-Recessed Mullions:

1. Basis of Design: Construction Specialties Model RS-7705.
2. Louver Depth: 7 in (175 mm), unless otherwise indicated.
3. Frame and Blade Nominal Thickness: As required by the engineered design.
4. Louver Performance Ratings:

a. Free Area: Not less than 8.0 sf (0.74 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 in (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a maximum core-area intake velocity of 483 fpm (2.5 m/s).

C. Horizontal, Storm-Resistant (Wind-Driven-Rain-Resistant) Louvers - Fully Recessed Mullions:

1. Basis of Design: Construction Specialties Model RS-7315.

2. Louver Depth: 7 in (175 mm), unless otherwise indicated.
3. Frame and Blade Nominal Thickness: As required by the engineered design.
4. Louver Performance Ratings:
   a. Free Area: Not less than 8.1 sf (0.75 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 in (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a core-area intake velocity of 283 fpm (1.5 m/s).

D. Horizontal, Storm-Resistant (Wind-Driven-Rain-Resistant) Louvers - Fully Recessed Mullions with Integrated Backup Panels:

1. Basis of Design: Construction Specialties Model MW-7315 with Centria MetalWrap Series MR-300 Insulated Backup Panels at inactive louver.
2. Louver Depth: 7 in (175 mm), unless otherwise indicated.
3. Frame and Blade Nominal Thickness: As required by the engineered design.
4. Louver Performance Ratings:
   a. Free Area: Not less than 8.1 sf (0.75 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 in (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a core-area intake velocity of 283 fpm (1.5 m/s).

E. Vertical, Storm-Resistant (Wind-Driven-Rain-Resistant) Louvers:

1. Basis of Design: Construction Specialties Model RSV-5700.
2. Louver Depth: 5 in (127 mm), unless otherwise indicated.
3. Frame and Blade Nominal Thickness: As required by the engineered design.
4. Louver Performance Ratings:
   a. Free Area: Not less than 7.3 sf (0.68 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 in (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a maximum core-area intake velocity of 977 fpm (5.0 m/s).
5. Certification: Mark units with AMCA or BSRIA Certified Ratings Seal.

F. Vertical, Perforated Face, Storm Resistant (Wind-Driven-Rain-Resistant) Louvers:

1. Basis of Design: Construction Specialties Model PL-5700.
2. Louver Depth: 7 in (100 mm), unless otherwise indicated.
3. Frame and Blade Nominal Thickness: As required by the engineered design.
4. Louver Performance Ratings:
   a. Free Area: Not less than 7.12 sf (0.66 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 in (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a maximum core-area intake velocity of 984 fpm (5.0 m/s).
5. Certification: Mark units with AMCA or BSRIA Certified Ratings Seal.

G. Horizontal, Continuous-Line, Drainable-Blade Louvers: Drainable-blade louver with blade gutters (drains) in rear two-thirds of blades only and with semi-recessed mullions capable of collecting and draining water from blades.

1. Basis of Design: Construction Specialties Model A6155.
2. Louver Depth: 6 in (150 mm).
3. Frame and Blade Nominal Thickness: Not less than 0.080 in (2 mm).
4. Louver Performance Ratings:
   a. Free Area: Not less than 7.8 sf (0.72 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Maximum Recommended Free Area Velocity: Not less than 847 fpm (4.3 m/s).
   c. Free Area Velocity at Point of Beginning Water Penetration: Not less than 1047 fpm (5.3 m/s).

H. Horizontal, Non-Drainable-Blade Louvers:

1. Basis of Design:
   a. Louver Depth: 4 in (100 mm); Construction Specialties Model A4080
   b. Louver Depth: 6 in (150 mm); Construction Specialties Model A6080
2. Blade Profile: Plain blade without center baffle.
3. Frame and Blade Nominal Thickness: Not less than 0.080 in (2 mm).
4. Mullion Type: Semi-recessed.
5. Louver Performance Ratings - Model A4080:
   a. Free Area: Not less than 8.65 sf (0.80 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Maximum Recommended Free Area Velocity: Not less than 604 fpm (3.1 m/s).
   c. Free Area Velocity at Point of Beginning Water Penetration: Not less than 804 fpm (4.1 m/s).
6. Louver Performance Ratings - Model A6080:
   a. Free Area: Not less than 8.24 sf (0.80 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Maximum Recommended Free Area Velocity: Not less than 700 fpm (3.56 m/s).
   c. Free Area Velocity at Point of Beginning Water Penetration: Not less than 900 fpm (4.57 m/s).

I. Horizontal, Windborne-Debris-Impact-Resistant Louvers - Exposed Mullions:

1. Basis of Design: Construction Specialties Model DCH-5704.
2. Louver Depth: 5 in (125 mm), unless otherwise indicated.
3. Frame and Blade Nominal Thickness: As required by the engineered design.
4. Louver Performance Ratings:
   a. Free Area: Not less than 7.3 sf (0.67 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 8 in (203 mm) per hour and a wind speed of 50 mph (22.4 m/s) at a maximum core-area intake velocity of 285 fpm (1.5 m/s).
5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
   a. AMCA 540, Louvers Impacted by Wind Borne Debris.

J. Horizontal, Wind-Driven Rain-Resistant, Windborne-Debris-Impact-Resistant Louvers - Fully Recessed Mullions:

1. Basis of Design: Construction Specialties Model DC-9614.
2. Louver Depth: 9 in (125 mm), unless otherwise indicated.
3. Frame and Blade Nominal Thickness: As required by the engineered design.

4. Louver Performance Ratings:

   a. Free Area: Not less than 9.46 sf (0.88 sm) for 48 in. (1200 mm) wide by 48 in. (1200 mm) high louver.
   b. Wind Driven Rain Performance: Not less than 99 percent effectiveness when subjected to rainfall rate of 8 in. (203 mm) per hour and a wind speed of 50 mph (22.4 M/s) at a maximum core area intake velocity of 977 fpm (5.0 m/s).

5. AMCA Seal: Mark Units with AMCA Certified Ratings Seal.

   a. AMCA Rating:

      1) AMCA 540, Louvers Impacted by Wind Borne Debris.
      2) AMCA 550, High Velocity Wind Driven Rain Resistant Louvers.

K. Vertical, Wind-Driven Rain-Resistant, Windborne-Debris-Impact-Resistant Louvers - Exposed Mullions:

1. Basis of Design: Construction Specialties Model RS-5800.
2. Louver Depth: 5 in (125 mm), unless otherwise indicated.
3. Frame and Blade Nominal Thickness: As required by the engineered design.
4. Louver Performance Ratings:

   a. Free Area: Not less than 8.67 sf (0.81 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 8 in (203 mm) per hour and a wind speed of 50 mph (22.4 m/s) at a maximum core-area intake velocity of 984 fpm (5.0 m/s).

5. AMCA Seal: Mark Units with AMCA Certified Ratings Seal.

   a. AMCA 540, Louvers Impacted by Wind Borne Debris.
   b. AMCA 550, High Velocity Wind Driven Rain Resistant Louvers.

L. FEMA Windborne Compliant Shelter Louver - Exposed Mullions:

1. Basis of Design: Construction Specialties Model EW 5210.
2. Louver Depth: 5 in. (127 mm).
3. Frame and Nominal Thickness: As required by the engineered design.
4. Louver Performance Ratings:

   a. Free Area not less than 7.22 sf (0.671 ms) for 48 in. (1200 mm) wide by 48 in. (1200 mm) high louver.
   b. Free Area Velocity at Point of Beginning Water Penetration: Not less than 525 fpm (2.7m/s).

5. Compliance: FEMA P-361, ICC 500, ASTM E330.

M. Vertical, Sand-Resistant Louvers:

1. Basis of Design: Construction Specialties Model S-4770.
2. Louver Depth: 5 in (127 mm), unless otherwise indicated.
3. Frame and Blade Nominal Thickness: As required by the engineered design.
4. Louver Performance Ratings:

   a. Free Area: Not less than 4.56 (0.42 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Sand Rejection Performance: Not less than 84 percent effectiveness when subjected to sand at a core-area intake velocity of 197 fpm (1.0 m/s).

5. Certification: Mark units with AMCA or BSRIA Certified Ratings Seal.

2.7 FIXED, FORMED-STEEL LOUVERS

A. Horizontal, Formed-Steel Louvers:

1. Basis of Design: Construction Specialties Model GS-410.
2. Louver Depth: 4 in (100 mm).
3. Blade Profile: Plain blade without center baffle.
4. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 in (1.32 mm).
5. Mullion Type: Semi-recessed.
6. Louver Performance Ratings:

   a. Free Area: Not less than 6.8 sf (0.632 sm) for 48 in (1200 mm) wide by 48 in (1200 mm) high louver.
   b. Maximum Recommended Free Area Velocity: Not less than 533 fpm (2.7 m/s).
   c. Free Area Velocity at Point of Beginning Water Penetration: Not less than 733 fpm (3.7 m/s).

2.8 SCREENWALL / VISION BARRIERS

A. Horizontal, Vision Barrier: Blades supported and aligned with extruded aluminum blade braces positively interlocked to each blade and mechanically secured to extruded aluminum supports.

1. Basis of Design: Construction Specialties; Vert-A-Cade 301 Aluminum Screen.
2. Louver Depth: 4 in (100 mm).
3. Blade Spacing: 6 3/4 inches on center with a 50 % Free Area.
4. Frame and Blade Material and Nominal Thickness: Extruded aluminum 6063-T5 alloy, not less than 0.081 in.

2.9 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location: Interior face, unless otherwise indicated.
2. Screening Type: Bird screening, unless otherwise indicated.

   a. Sand screening, where indicated on the Drawings.
   b. Insect screening, where indicated on the Drawings.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 in (150 mm) from each corner and at 12 in (300 mm) on center.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Bird Screening Type: Non-rewirable, U-shaped frames.
4. Sand Screening Type: 0.055 in (1.4 mm) thick extruded aluminum frames.
5. Insect Screening Type: Rewirable frames with a driven spline or insert for securing screen mesh.

D. Louver Screening:

1. Bird Screening: Aluminum, 1/2 in (12 mm) square mesh, 0.063 in (1.60 mm) wire.
2. Sand Screening: Aluminum, 5/8 in (15 mm) flattened expanded mesh.
3. Insect Screening: Aluminum, 18 by 16 (1.4 mm by 1.6 mm) mesh, 0.012 in (0.30 mm) wire.

2.10 BLANK-OFF PANELS

A. General: Fabricate blank-off panels from same materials and finish applied to louvers, but black color. Attach blank-off panels to back of louver frames with stainless-steel sheet-metal screws.

B. Insulated, Blank-Off Panels: Laminated panels consisting of insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: 2 in (50 mm).
2. Metal Facing Sheets: Aluminum sheet, not less than 0.032 in (0.8 mm) nominal thickness.
3. Insulating Core: Rigid, glass-fiber-board insulation.
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080 in (2 mm) nominal thickness, with corners mitered and with same finish as panels.
5. Seal perimeter joints between blank-off panel faces and louver frames with gaskets or sealant to provide watertight louver assembly.

C. Un-Insulated, Blank-Off Panels: Aluminum sheet, not less than 0.050 in (1.25 mm) nominal thickness.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of accepted Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of accepted Samples and are assembled or installed to minimize contrast.

D. Match Adjacent Aluminum Framing: Finish wall louver system components to match adjacent glazed aluminum framing system as specified in Division 08 Section "Glazed Aluminum Framing System".

E. Finish Selections: As scheduled or as indicated in Design Selections.

2.12 ALUMINUM FINISHES

A. Finish designations comply with the systems established by the Aluminum Association and AAMA / FGIA for designating aluminum finishes.

B. Fluoropolymer Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish complying with AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

C. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

D. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

2.13 GALVANIZED-STEEL SHEET FINISHES

A. Finish louvers after assembly.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A 780.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Selections: As scheduled or as indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.4 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

1. All fasteners shall be stainless steel.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control

1. Refer to Division 01 Section Field Test for Air and Water Leakage.
2. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.6 ADJUSTING AND CLEANING

A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.

B. Clean exposed surfaces of louvers that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.7 LOUVER SCHEDULE

A. Horizontal, Storm-Resistant Louvers:

1. Locations within exterior walls at typical and other unprotected locations.
2. Locations as scheduled or indicated on the Drawings.

B. Vertical, Storm-Resistant Louvers:

1. Locations within exterior walls at typical and other unprotected locations.
2. Locations as scheduled or indicated on the Drawings.

C. Vertical, Perforated Face, Storm Resistant Louvers:

1. Locations within exterior walls at typical and other unprotected locations.
2. Locations as scheduled or indicated on the Drawings.

D. Horizontal, Continuous-Line, Drainable-Blade Louvers:

1. Locations within exterior walls at semi-protected locations not exposed to rain.
2. Locations as scheduled or indicated on the Drawings.

E. Horizontal, Non-Drainable-Blade Louvers:

1. Locations within Parking Garages and other locations not exposed to rain.
2. Locations as scheduled or indicated on the Drawings.

F. Horizontal, Hurricane-Resistant Louvers:

1. Locations within exterior walls at typical and other unprotected locations.
2. Locations as scheduled or indicated on the Drawings.

G. Vertical, Hurricane-Resistant Louvers:

1. Locations within exterior walls at typical and other unprotected locations.
2. Locations as scheduled or indicated on the Drawings.

H. FEMA Windborne Compliant Shelter Louver:

1. Locations as scheduled or indicated on the Drawings.

I. Vertical, Sand-Resistant Louvers:

1. Locations within exterior walls at typical and and other unprotected locations.
2. Locations as scheduled or indicated on the Drawings.

J. Horizontal, Formed-Steel Louvers:

1. Interior locations only.

K. Screenwall / Vision Barriers:

1. Locations as scheduled or indicated on the Drawings.

3.8 ARCHITECTURAL METAL FINISH SCHEDULE

A. Color and Gloss:

B. Color and Gloss: Match sample accepted by Architect.

C. Color Anodic Finish:

1. Color: Light bronze.
2. Color: Medium bronze.
3. Color: Dark bronze.
4. Color: Black.

D. Basis of Design: AMFXX

1. Manufacturer:
2. Product Series:
3. Color Name and Number:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 090600
ROOM FINISH SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes Room Finish Schedule for finishes technically specified in various technical Sections of this Project Manual.

1.2 ROOM FINISH SCHEDULE

A. Attached and included as part of this section: Room Finish Schedule.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 092400
PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Portland cement plastering and supplementary items necessary for installation for the following:

1. Exterior Walls: Direct bond Portland cement plastering, with modified cement waterproofing base coat, over cementitious substrates.
2. Exterior / Interior Walls: Portland cement plastering over metal lath.
3. Exterior Soffits and Ceilings: Portland cement plastering over metal lath on suspended framing system.
4. Accent Trim: Plaster system foam trim.

B. Related Requirements:

1. Refer to Owner Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

1.2 DELEGATED ENGINEERING REQUIREMENTS FOR SUSPENDED SOFFIT FRAMING

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturers specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work.

1. Show locations and installation of control and expansion joints; indicated on all project elevations.

C. Samples for Verification Purposes: Submit samples for each item listed below of size and construction indicated. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. 18 in (450 mm) square layered sample consisting of each Portland Cement Plaster System layer; prepared on rigid backing.
2. 12 in (300 mm) long sample of each metal trim accessory.
3. 12 in (300 mm) long flashing with end dam.
4. 12 in (300 mm) long sample of each foam trim profile.

1.4 INFORMATIONAL SUBMITTALS

A. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Product Approvals: Submit Product Control Notice of Acceptance (NOA) issued by Miami-Dade County Building Code Compliance Office (BCCO) or other product approval acceptable to authorities having jurisdiction for systems used at exterior of building.

C. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

D. List of Materials for Layered Mock-Up for Construction Quality Purposes:

1. Product, material, and equipment names, model numbers, lot numbers, batch numbers, source of supply, and other information required to identify items used. Include mix proportions for plaster and source of aggregates.
2. Receipt of list does not constitute approval of deviations from Contract Documents, unless such deviations are specifically accepted by Architect in writing.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 10 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 10 years of experience installing products and systems similar to scope of this Project.

C. Exterior and Interior Plastering Work Plan: Written plan detailing methods, materials and equipment to be used to comply with weather requirements.

1.6 MOCKUPS

A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

B. Layered Mock-Up for Construction Quality Purposes: In addition to the Mock-ups described above and prior to Pre-Installation Conference; build layered mock-ups for each type of plastering assembly specified to demonstrate qualities of materials and to verify Work construction execution quality with Contract Documents (not for aesthetic qualities), using specified materials:

1. Notify Architect 7 days in advance of the dates and times when mock-up will be installed.
2. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.
b. Clean exposed faces of mock-up prior to presentation to Architect.

3. Obtain Architect's acceptance of mock-ups before starting installation of permanent Work for the Project. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
4. Protect accepted mock-ups from the elements with weather-resistant membrane.
5. Maintain accepted mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
6. Arrange installation of products and materials in layered fashion to allow observation into concealed areas of assembly; including the following:

a. Plastering in specified finish, including accents and design details.
b. Wall back-up, complete with steel studs, sheathing, building paper, and air and water barrier.
c. Wall back-up, complete with cementitious substrate and waterproofing.
d. Metal lath and accessories.
e. Head, jamb, and sill of window or door opening:

1) Head shall include lintels, flashings, and accessories.

2) Jambs shall include edge flashings.
3) Sills shall include flashings.

7. Acceptance of layered mock-ups is for following Work execution qualities:

a. Application of modified cement waterproofing.
b. Installation and attachment of building paper and metal lath.
c. Application of Portland cement plaster.
d. Installation and attachment of accessories, including joinery.
e. Plastering uniformity and consistency.
f. Attachments of plaster system foam trim.
g. Other material and construction qualities as determined by Architect.

8. Demolish and remove mock-ups when directed by Architect.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver products in original unopened packages or containers, fully identified with intact and legible labels.

B. Storage: Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.9 PROJECT CONDITIONS

A. Comply with ASTM C 926.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
    a. Protect Work against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial.
2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
    a. Provide heat and protection (temporary or permanent) as required to protect Work from freezing.
    b. Distribute heat uniformly to prevent concentration of heat near sources; provide deflection or protective screens.

C. Stain Prevention: Prevent soil from staining exposed plaster. Immediately remove soil from exposed plaster.
1. Protect base of walls from rain-splashed mud and plaster splatter.
2. Protect sills, ledges, and projections from plaster droppings.
3. Protect surfaces of window and door frames, and other adjacent with painted and integral finishes from plaster droppings.
4. Turn scaffolding planks near work on edge at end of each day to prevent rain from splashing plaster droppings or dirt onto face of exposed plaster.

D. Interior Plasterwork: Maintain room temperatures at greater than 40 deg F (4.4 deg C) for at least 48 hours before plaster application, and continuously during and after application.
1. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
2. Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

E. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products specified under each item below to establish a standard of quality. Other available manufacturers with

products having equivalent characteristics may be considered, provided deviations are minor and does not change intent of Contract Documents as judged by Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS HIGH VELOCITY WIND ZONES

A. Windborne-Debris-Impact-Resistance Performance: Comply with impact resistance testing requirements for Wind Zone.

2.4 PERFORMANCE REQUIREMENTS FOR SOFFIT AND CEILING FRAMING

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Cold Formed Metal Framing: Refer to Division 5 Section Cold Formed Metal Framing for soffits and ceilings constructed with cold formed metal framing.

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads.

1. Live Load Deflection: Accommodate differential vertical deflection of floors:

a. Deflection: As indicated on Drawings.

D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

E. Deflection of Framing Members: At design wind pressure.

1. Deflection of Framing Members Normal to Surface Plane: Limited to 1/360 of span.

F. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

G. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.5 SUSPENDED FRAMING SYSTEM FOR SUSPENDED SOFFITS AND CEILINGS

A. Material Quality Standard: Provide components of sizes indicated but not less than that required to comply with ASTM C 754 for conditions indicated.

B. Protective Coating - Standard Applications: ASTM A 653 / A 653M, G60 (Z180) hot-dip galvanized coating.

C. Protective Coating - High Moisture / Humidity (Coastal) Applications: ASTM A 653 / A 653M, G90 (Z275) hot-dip galvanized coating.

D. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.

   a. Cast-in-place anchor, designed for attachment to concrete.
   b. Post-installed chemical anchor.
   c. Post-installed expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
3. Manufacturers:

   a. Construction Materials, Inc.
   b. Heckman Building Products, Inc.
   c. Hilti Corp.
   d. ITW Ramset/Red Head.
   e. Powers Fasteners.
   f. Simpson Strong Tie Anchor Systems.

4. For post-tensioned concrete, anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

E. Wire:

1. Material Quality Standard: ASTM A 641 / A 641M, Class 1, zinc-coated, soft annealed, mild steel wire.
2. Tie Wire Minimum Size: Single 0.0625 in (16 gage) (1.6 mm) diameter strand, or double 0.0475 in (18 gage) (1.2 mm) diameter strands.
3. Hanger Wire Minimum Size: 0.1620 in (8 gage) (4.12 mm) diameter.

F. Channels: Cold-rolled steel, ASTM C 645, 0.0538 in (16 gage) (1.3 mm) minimum thickness of base metal (uncoated), and as follows:

1. Carrying Channels: 1-1/2 in (38 mm) deep by 1/2 in (12 mm) wide flanges; 414 lbs per 1000 ft (0.616 kg/m).
2. Furring Channels: 3/4 in (19 mm) deep by 1/2 in (12 mm) wide flanges; 277 lbs per 1000 ft (0.412 kg/m).

2.6 PLASTERING MATERIALS

A. Modified Cement Waterproofing (at Direct Bond Plastering):

1. Product Description: Proprietary prepackaged blend of dry cementitious and other ingredients for mixing with polymer admixture to produce a waterproof coating suitable for vertical applications behind Portland cement plaster; with following minimum physical properties:

   a. Permeability: Minimum 12 perms according to ASTM E 96 / E 96M.
   b. Salt Spray Resistance: No defect according to ASTM B 117.

c. Artificial Weathering: No failure after 5,000 hours according to ASTM G 26.

2. Basis of Design: Sika Corp.; MasterSeal 581 with MasterEmaco A 660.
3. Manufacturers:

a. AQUAFIN, Inc.
b. Sika Corp., Inc.
c. Tamms Industries, Inc.
d. Vandex International, Inc.

B. Portland Cement:

1. Product Quality Standard: ASTM C 150, Type I; except Type III may be used for cold-weather construction.
2. Color: Natural gray color or white cement as required producing color required.
3. Manufacturers:

a. Lafarge North America.
b. Lehigh Cement Co.
c. Lone Star Industries, Inc.
d. Rinker Materials.
e. Royal White Cement.

C. Types of Cement Not Permitted: ASTM C 91 masonry cement and ASTM C 1329 mortar cement are not acceptable and shall not be used.

D. Hydrated Lime:

1. Product Quality Standard: ASTM C 206, Type S.
2. Manufacturers:

a. Graymont Dolime (OH) Inc.
b. Rockwell Lime Co.

E. Sand Aggregate: ASTM C 897.

F. Reinforcing Fiber: Alkaline-resistant glass or polypropylene, 1/2 in (12 mm) long, free of contaminants, manufactured for use in Portland cement plaster.

G. Water: Potable.

H. Ready-Mixed Base Coat Plaster: Factory-proportioned and pre-blended Portland cement, lime, alkali-resistant fibers, sand and proprietary additives complying with ASTM C926 for use in scratch and brown coat applications. Components of pre-blended mixes are limited to the Plastering Materials and standards listed in this section.

1. Available Manufacturers and Products:

a. Sika Corp.; ParexLaHabra, Inc.; Fiber-47 Fastwall Scratch and Brown Fiber Reinforced Sanded.
b. Quikrete Companies; Scratch and Brown Coat Fiber Reinforced Stucco.
c. Spec Mix; Scratch and Brown Fiber Reinforced Stucco.

I. Acrylic Admixture:

1. Description: Water-based, non-redisperable one-component acrylic polymer, resistant to ultraviolet light degradation.
2. Available Manufacturers and Products:

a. Sika Corp.; MasterEmaco A 660.
b. Euclid Co.; Akkro 7-T.

c. Larsen Products Corp.; Acrylic Admix-101.
d. Sika Corp.; Parex Adacryl.
e. Mapei Corp.; Planicrete AC.
f. United States Gypsum Company (USG); Acri-Add 100 percent Acrylic Add-Mix Fortified.

2.7 FINISH SYSTEMS

A. Textured Acrylic Coating Finish System:

1. Description: Water-based, high-build 100 percent acrylic, waterproof coating system formulated with acrylic emulsion, colorfast mineral pigments, fine aggregates, fillers, and other proprietary ingredients; for use over Portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
2. Available Manufacturers and Products:

a. Sika Corp.; MasterProtect HB 400.
b. Euclid Chemical Company; Tamms Tammscoat.
c. PPG Industries, Inc.; Perma-Crete Texture Finishings
d. Sherwin-Williams Company; UltraCrete Textured Masonry Topcoat.
e. Textured Coatings of America, Inc.; Tex-Cote 600 Textured Coating.

3. Acrylic Primer: Manufacturer recommended acrylic primer.
4. Basis of Design: Sika Corp.; MasterProtect HC 400.

a. Color and Texture: Provide products equivalent to color, finish, appearance, texture, and quality of products scheduled or indicated in Design Selections.

5. Related Section: Refer to Division 09 Section Textured Acrylic Coatings.

B. Textured Acrylic Coating Finish System:

1. Description: Factory-mixed acrylic emulsion coating system formulated with colorfast pigments, fine aggregates, fillers, and other proprietary ingredients; for use over Portland cement plaster base coats. Include manufacturers recommended primers and sealing topcoats for acrylic-based finishes.
2. Available Manufacturers and Products:

a. Sika Corp.; Parex DPR Finish.
b. Dryvit; DPR Finish.
c. Sto Corp.; Stolit Finish.
d. Sika Corp.; Acrylic Finish.

3. Acrylic Primer: Manufacturer recommended acrylic primer. Application of primer is required.

C. Ready-Mixed Integrally-Colored Cement Plaster Finish Coat:

1. Description: Mill-mixed Portland cement, aggregates, coloring agents, and proprietary ingredients.
2. Basis of Design Color and Texture Selection: Provide products equivalent to color, finish, appearance, texture, and quality of products as scheduled or as indicated in Design Selections.
3. Manufacturers and Products:

a. California Stucco Products Corp.; Conventional Portland Cement Stucco.
b. Sika Corp.; Parex El Rey Premium Stucco Finish.
c. Florida Stucco; Florida Stucco.
d. Sika Corp.; LaHabra Exterior Stucco Color Coat.

e. Omega Products International, Inc.; ColorTek Exterior Stucco.
f. Quikcrete; Quikcrete Finish Coat Stucco, No. 1201.
g. Sika Corp.; Synergy Stucco.
h. United States Gypsum Company (USG); Oriental Exterior Finish Stucco.

D. Exterior Adhered Masonry Veneer: As specified in Division 04 Section Adhered Masonry Veneer.

2.8 EMBEDDED FLASHING MATERIALS

A. Sheet Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA "Architectural Sheet Metal Manual" and as follows:

1. Material:

a. Product Quality Standard: ASTM A 240 / A 240M or A 666, Type 304.
b. Product Quality Standard: ASTM A 240 / A 240M or A 666, Type 316.
c. Description: Stainless steel, 2D annealed finish, not less than 0.025 in (24 ga) (0.64 mm) thick, unless noted otherwise.

2. Solder:

a. Product Quality Standard: ASTM B 32, Grade Sn60.
b. Description: Solder with acid flux of type recommended by stainless steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.

B. Rubberized Asphalt Flashing:

1. Description: Minimum 40 mils (1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
2. Manufacturers and Products:

a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
b. Grace Construction Products; Perm-A-Barrier Wall Flashing.
c. Henry Co., Blueskin TWF.
d. Polyguard Products, Inc.; 401 Membrane.
e. Tamko Building Products; TW-Thru Wall Flashing.
f. Williams Products, Inc.; Everlastic MF-40.

C. High-Temperature Rubberized Asphalt Flashing:

1. Description: Minimum 40 mils (1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
4. Manufacturers and Products:

a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
b. Grace Construction Products; Ultra.
c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

D. Sealant for Sheet Metal Flashing: Exterior non-sag silicone sealant as specified in Division 07 Section Joint Sealants.

2.9 METAL ACCESSORIES

A. General: The specifications for the accessories listed below are based upon the specified zinc alloy products as the design standards.

B. Casing Beads:

1. Product Description: Square edge, expanded metal flange; perforated with minimum 1/4 in (6 mm) diameter holes at 12 in (300 mm) on centers when used at bottom of plaster, non-perforated elsewhere; size required for plaster thickness.
2. Material Quality Standard: ASTM B 69, 99 percent pure zinc alloy.
3. Manufacturers and Products:

a. Alabama Metal Industries Corp. (AMICO); X-66 Casing Bead (Plaster Stop).
b. California Expanded Metal Co. (CEMCO); No. 66 Expanded Flange Casing Bead.
c. Clarkwestern Dietrich Building Systems; No. 66 Expanded Flange Casing Bead.
d. Niles Building Products Co.; No. 66-X Expanded Flange Casing Bead.

C. Outside Corner Reinforcement:

1. Product Description: Small nose corner beads, expanded metal flanges, with continuous stiffening ribs.
2. Material Quality Standard: ASTM B 69, 99 percent pure zinc alloy.
3. Manufacturers and Products:

a. AMICO (Alabama Metal Industries Corp.); X2 Cornerbead.
b. Clarkwestern Dietrich Building Systems; No. 2A Expanded Corner Bead.

D. Foundation Weep Screed:

1. Product Description: Sheet metal with horizontal V-shape, with punched holes to allow moisture weeping, below 3-1/2 in (87 mm) wide nailing flange; size required for plaster thickness.
2. Material Quality Standard: ASTM B 69, 99 percent pure zinc alloy.
3. Manufacturers and Products:

a. Alabama Metal Industries Corp. (AMICO); Foundation Weep Screed (#7).
b. California Expanded Metal Co. (CEMCO); No. 7 Foundation Sill Screed.
c. Clarkwestern Dietrich Building Systems; FHA-7 Weep Sill Screed.
d. Niles Building Products Co.; No. 7 Foundation Weep Screed.

E. Expansion Joint:

1. Product Description: Two-piece, slip joint that allows multi-directional movement; size required for plaster thickness.
2. Material Quality Standard: ASTM B 69, 99 percent pure zinc alloy.
3. Manufacturer and Product:

a. California Expanded Metal Co. (CEMCO); M-Slide Expansion Joint.

F. Control Joint:

1. Product Description: Back-to-back J-shape that permits positive locking with plaster, expanded metal lath flange; size required for plaster thickness.
2. Material Quality Standard: ASTM B 69, 99 percent pure zinc alloy.
3. Manufacturers and Products:

a. Alabama Metal Industries Corp. (AMICO); XJ15 Griplock Expansion Control Joint.

b. Clarkwestern Dietrich Building Systems; No. XJ15 Control Joint.
c. Niles Building Products Co.; Double J Expansion Control Joint.

2.10 PLASTIC ACCESSORIES

A. Plastic Accessories: Fabricated from high-impact PVC.

1. Manufacturers:

a. Alabama Metal Industries Corporation; a Gibraltar Industries Company.
b. Phillips Manufacturing Co.
c. Plastic Components, Inc.
d. Clarkwestern Dietrich Building Systems; Vinyl Corp.

2. Cornerbeads: With perforated flanges.

a. Small nose cornerbead; use unless otherwise indicated.
b. Bull nose cornerbead, radius 3/4 in (19 mm) minimum; use at locations indicated on Drawings.

3. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.

a. Square-edge style; use unless otherwise indicated.
b. Bull-nose style, radius 3/4 in (19 mm) minimum; use at locations indicated on Drawings.

4. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
5. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged reveal width as required for plaster thickness; with perforated concealed flanges.

2.11 METAL LATH

A. Expanded Metal Lath:

1. Product Quality Standard: ASTM C 847 with ASTM A 653 / A 653M, G60 (Z180), hot-dip galvanized zinc coating.
2. Description: Expanded, diamond mesh lath, 3.4 lb/sq yd (1.8 kg/sq m), of following types:

a. Self-furred (dimpled) over solid substrates.
b. Flat type suspended soffits and ceilings.

3. Manufacturers:

a. Alabama Metal Industries Corp. (AMICO); a Gibraltar Industries Company.
b. California Expanded Metal Co. (CEMCO).
c. Clarkwestern Dietrich Building Systems.
d. Marino / WARE.
e. Niles Building Products Co.
f. Phillips Manufacturing Co.

B. Lath Tie Wire: ASTM A 641 / A 641M, Class 1 galvanized, not less than 0.0475 in (18 ga) (1.2 mm) diameter, soft temper.

C. Strip Lath Reinforcement:

1. Product Description: Strips of expanded metal lath, 4 in (100 mm) to 6 in (150 mm) wide, with smooth edges.

2. Material Quality Standard: Hot-dip galvanized steel, ASTM A 653 / A 653M, G60 (Z180) zinc coating.
3. Manufacturers and Products:
   a. Alabama Metal Industries Corp. (AMICO); Striplath.
   b. California Expanded Metal Co. (CEMCO); Stripite.
   c. Clarkwestern Dietrich Building Systems; Striplath.

D. Inside Corner Reinforcement:
1. Product Description: Strips of galvanized expanded metal lath, minimum 3 in (75 mm) wide flanges, folded to 105 degrees, with smooth edges.
2. Material Quality Standard: Hot-dip galvanized steel, ASTM A 653 / A 653M, G60 (Z180) zinc coating.
3. Manufacturers and Products:
   a. Alabama Metal Industries Corp. (AMICO); Cornalath.
   b. California Expanded Metal Co. (CEMCO); Cornerite.
   c. Clarkwestern Dietrich Building Systems; Cornerite.

E. Welded Wire Fabric:
1. Welded-Wire Lath: ASTM C933; self-furring, 1.95 lb/sq. yd. (1.1 kg/sq. m).
2. Available Manufacturers and Products:
   a. Structa Wire Corp.; Megalath.

2.12 FASTENERS

A. Screw Fasteners for Attaching Metal Lath to Sheathed Steel Studs:
1. Product Quality Standard: ASTM C 1063.
2. Description: Self-drilling and self-tapping screws with pan or wafer type head of size to engage 3 strands of lath; fabricated from corrosive resistant or nonferrous metal; in lengths required to achieve minimum penetration of 3/8 in (10 mm) beyond stud.

B. Powder Actuated Fasteners for Attaching Metal Lath to Cementitious Substrates:
1. Product Quality Standard: ANSI A10.3.
2. Product Description: Low velocity, powder actuated fasteners, stainless steel drive pins, length as required for minimum 3/4 in (19 mm) long penetration, with washers sized engage 3 strands of lath; powder loads suitable for application indicated; sufficient to correctly attach or anchor metal lath to substrate indicated without failure.
3. Manufacturers:
   a. Hilti Corp.
   b. ITW Ramset/Red Head.
   c. Powers Fasteners.
   d. Simpson Strong Tie Anchor Systems.

2.13 PLASTER SYSTEM FOAM TRIM

A. Expanded Polystyrene Trim: Molded, rigid cellular polystyrene complying with ASTM C 578, Type I and EIMA "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for most stringent requirements for material performance qualities, including dimensions and permissible variations, and following:
1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than 6 weeks or by another method approved by EIMA that produces equivalent results.

2. Surface Burning Characteristics: Products and construction identical to assemblies tested for fire resistance according to ASTM E 84 / NFPA 255/UL 723 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

   a. Flame Spread: Class A - no greater than 25.
   b. Smoke Developed: No greater than 450.

3. Density: 1 lb/cu ft (16 k/cu m).
4. Shapes: Cut or molded profiles and dimensions indicated.
5. Manufacturers:

   a. AAA Architectural Elements & Coatings, Inc.
   b. Canamould Exterior Mouldings and Decorative Trim.
   c. Foam Concepts, Inc.
   d. Global Foam Co.
   e. Shape Formation, Inc.
   f. Vefo Inc.

B. Exterior Insulation and Finish System (EIFS) Components:

1. Foam Trim Adhesive: EIFS manufacturer's standard factory-mixed formulation, compatible with substrate and designed for adhesive attachment of expanded polystyrene trim to substrates indicated.
2. Reinforcing Mesh: Balanced, alkali-resistant, open-weave fiberglass mesh compatible with other materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 foot pounds per inch according to EIMA 105.01, complying with ASTM D 578 and following requirements for minimum weight:

   a. Standard Reinforcing Mesh: Not less than 4.0 oz/sq yd (136 g/sq m).
   b. Intermediate Reinforcing Mesh: Not less than 10.0 oz/sq yd (340 g/sq m).
   c. Impact-Resistant Reinforcing Mesh: Not less than 15.0 oz/sq yd (509 g/sq m).
   d. Strip Reinforcing Mesh: Not less than 3.75 oz/sq yd (128 g/sq m).
   e. Detail Reinforcing Mesh: Not less than 4.0 oz/sq yd (136 g/sq m).
   f. Corner Reinforcing Mesh: Not less than 7.2 oz/sq yd (245 g/sq m).

3. Waterproof Base-Coat Materials: EIFS manufacturers standard waterproof mixture of ASTM C 150, Type I, white or natural color portland cement and manufacturer's standard polymer-emulsion adhesive.
4. Manufacturers:

   a. Dryvit Systems, Inc.
   b. Omega Products International, Inc.
   c. Sika Corp.; Parex.
   d. Sika Corp.; Senergy Inc. Construction.
   e. Sto Corp.; Sto Finish Systems Div.

2.14 RELATED MATERIALS

A. Building Paper:

1. Product Quality Standard: Fed. Spec. UU-B-790a, Type 1, Grade D, Style 2.
2. Description: Two-ply asphalt saturated Grade D vapor permeable sheathing paper.
3. Minimum Physical Properties and Performance Requirements:

   a. Water Penetration Resistance: 110 minutes according to ASTM D 779.
   b. Water Vapor Transmission: 10 perms Minimum Vapor Transmission according to ASTM E 96, Procedure A.

4. Manufacturer and Product: Fortifiber Corp.; Two Ply Jumbo Tex.

B. Drainage and Ventilation Mat:

1. Description: Tangled filament nylon drainage mat designed to promote drainage and drying of above grade wall assemblies.

   a. Flame Spread: ASTM E-84; Flame Spread less than or equal to 25; Smoke Developed less than or equal to 450.
   b. Thickness: 1/4-inch nominal.

2. Manufacturer and Product: Sto Corp; DrainScreen.

2.15 PLASTER MIXES AND COMPOSITIONS

A. Mix Quality Standard: ASTM C 926, Types as indicated.

B. Mixing:

1. General:

   a. Size mixer to produce batches that will be applied within maximum 1-1/2 hours after mixing.
   b. Accurately proportion materials for initial plaster mixture using measuring devices of known volume.
   c. Use damp, loose sand.
   d. Retempering of base coat mixes is permitted one time only after initial mixing. Plaster not used with 1-1/2 hours of initial mixing shall not be used.
   e. Retempering of finish coat mixes is not permitted.

2. Mechanical Mixing:

   a. Mix each batch separately; double batching with single batch discharge is not permitted.
   b. Maintain mixer in clean condition before, during, and after mix preparation. Remove partially set and hardened plaster from mixer drum before next batch.
   c. Maintain mixer in continuous operation while charging mixer. Add water to bring mix to desired consistency. Continue mixing for 3 to 5 minutes after all ingredients have been added to mixer.

3. Hand Mixing: Not permitted.

C. General Job Mixed Base Coat Mix: Proportion materials for respective coats in parts by volume per sum of cementitious materials for aggregates to comply with following requirements for each method of application and plaster base indicated. Adjust mix proportions within limits specified to attain workability.

1. Reinforcing Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least 2 minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber per cu yd (0.6 kg of fiber per cu m) of cementitious materials.
2. Acrylic Admixture: Proportion in accordance with manufacturers recommendations and used in place of mixing water.

D. Mixes for Direct Bond Plastering over Cementitious Substrate:

1. Waterproofing: Modified cement waterproofing as specified elsewhere in this Section.
2. Brown Coat:

   a. 1 part Portland cement.
   b. 3/4 to 1-1/2 parts lime.
   c. 3 to 5 parts aggregate.

d. Reinforcing fibers.
e. Acrylic admixture.

E. Mixes for Plastering over Metal Lath:

1. Scratch Coat Mix:

a. 1 part Portland cement.
b. 0 to 3/4 parts lime.
c. 2-1/2 to 4 parts aggregate.
d. Reinforcing fibers.
e. Acrylic admixture.

2. Brown Coat Mix:

a. 1 part Portland cement.
b. 3/4 to 1-1/2 parts lime.
c. 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
d. Reinforcing fibers.
e. Acrylic admixture.

F. Finish Coat: Textured acrylic coating finish system as specified elsewhere in this Section. Mix as required by manufacturer's written instructions.

G. Finish Coat: Integrally colored cement plaster finish. Mix as required by manufacturers written instructions.

H. No finish coat at adhered masonry veneer installations.

2.16 METAL FLASHING FABRICATION

A. Field Measurements: Where metal flashing is to fit, cope, or be tailored to other construction, check actual dimensions of other construction by accurate field measurements before fabrication.

B. Fabrication Procedures: Fabricate continuous flashings in sections 96 in (2400 mm) long minimum, but not exceeding 12 ft (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.

1. Shop form flashing on a bending brake.
2. Shape, trim and hand seam on bench as far as practical with proper tools.
3. Form exposed metal Work without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated.
4. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.
5. Form materials to shape indicated with straight lines, sharp angles and smooth curves.
6. Fold and hem exposed edges of flashings.

C. Flashing Joinery: Fabricate interior and exterior corners, intersections, and complex flashing conditions in shop, rather than in field, with properly folded, constructed and continuous soldered joints. Field fabricated units are not permitted and will not be allowed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to which Portland cement plastering will be applied for compliance with requirements, installation tolerances and other conditions affecting performance. Proceed only when unsatisfactory conditions have been

corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

B. Verify that joints in concrete masonry unit surfaces are struck flush prior to start of plaster work. Refer to requirements as specified in Division 04 Section Concrete Unit Masonry.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturers instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Surface Conditioning: Immediately before plastering, dampen cementitious substrates that are indicated for direct application of plaster, except where a bonding agent has been applied. Determine and apply amount of moisture and degree of saturation that will result in optimum suction for plastering.

C. Substrate Condition: Verify that gypsum sheathing and air and water barrier are properly installed.

D. Steel Stud Framing: Locate and identify horizontal deflection tracks at top of wall framing.

E. Cleaning: Remove form oils, coatings, laitance, efflorescence, mortar, loose material and substances that would adversely affect or reduce bonding.

F. Temporary Grounds and Screeds: Install as necessary to ensure accurate rodding of plaster to true surfaces; coordinate with scratch-coat work.

3.4 INSTALLING FRAMING FOR SUSPENDED SOFFITS AND CEILINGS

A. General: Install framing level, plumb, square, or curved as required to receive Portland cement plastering.

B. Hangers: Suspend hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with mechanical and electrical equipment, insulation or other objects within plenum. Within limitations allowed by installation quality standards, splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within plenum produces hanger spacings that interfere with location of hangers required to support framing, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support loads within performance limits established by installation quality standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure rod, flat, or angle hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and

appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

C. Carrying Channels: Space not over 36 in (900 mm) on centers with hanger wires located at 48 in (1200 mm) on centers and within 6 in (150 mm) of carrying channel ends.

D. Furring Channels: Space furring channels not over 16 in (400 mm) on centers and wire tie to carrying channel at each crossing.

E. Compression Strut to Resist Vertical Uplift: Install one carrying channel as a compression strut for every 30 sq ft (9 m), located between carrying channels and structure above. Secure wire tie to vertical members.

F. Framed Openings: Frame openings in grillage with carrying channels supported on separate wire hangers and set frames for recessed items.

G. Building Expansion Joints: Provide double carrying channels or furring channels side by side where expansion joints occur. Do not continue channels over or across building expansion joints.

3.5 INSTALLING BUILDING PAPER

A. Install building paper barrier over the face of air and water barrier:

1. Delay installation until Portland cement plaster Work is to begin to minimize exposure of building paper.
2. Beginning at bottom of substrate wall, align horizontally; pull taut to eliminate fishmouths, wrinkles, buckles, and kinks; install in shingled manner to shed water without interception by exposed edges.
3. Offset building paper joints from sheet air and water barrier; lap horizontal joints 6 in (150 mm); lap vertical end joints 12 in (300 mm); stagger end laps; lap 12 in (300 mm) at inside and outside corners; lap flashing 6 in (150 mm).

3.6 INSTALLING DRAINAGE AND VENTILATION MAT

A. Install drainage and ventilation mat over air and water barrier in compliance with manufacturer instructions and requirements.

1. Starting at the bottom of the wall, hammer-tack drainage mat into sheathing or framing with as few fasteners as needed to hold in place. Do not fasten through flashing.
2. Shingle lap drainage mat at horizontal courses, flashing at floor lines, window heads and other flashing to direct water to exterior.
3. Butt end of rolls and vertical seams.
4. Immediately install lath over drainage mat.

3.7 INSTALLING METAL LATH

A. Installation of Metal Lath at Sheathed Steel Stud Walls covered with Building Paper and Air and Water Barrier:

1. Install multiple sheets of metal lath to form continuous plane over substrates.
2. Layout and arrange so that metal lath joints will not occur over vertical and horizontal laps of previously installed weather resisting sheets.
3. Begin installation at bottom of substrate wall; install with long dimension at horizontal and stagger vertical end laps.
4. Lap horizontal sides not less than 1/2 in (12 mm), and securely tie between steel stud supports with lath tie wire at not more than 9 in (225 mm) on centers vertically.
5. Securely attach metal lath to each steel stud support with screw fasteners at not more than 7 in (175 mm) on centers vertcially.

6. Lap vertical ends not less than 1 in (25 mm).
   a. If lap occurs over a steel stud support, securely attach with screw fasteners at not more than 7 in (175 mm) on centers vertically.
   b. If lap does not occur over a steel stud support, securely tie with lath tie wire at not more than 9 in (225 mm) on centers vertically.
7. Screw fasteners shall extend through not less than 3 strands of metal lath, weather resisting sheets, gypsum sheathing and into steel stud; tip of fastener shall extend beyond stud not less than 3/8 in (10 mm).
8. Expansion Joints: Do not extend metal lath behind or across expansion joints; attach each side of metal lath to separate joint accessory flange.
9. Control Joints: Extend metal lath behind or across control joints. Install control joints on top of metal lath without cutting the lath behind the control joint.
10. Do not attach metal lath to horizontal deflection track at top of wall framing.

B. Installation of Metal Lath at Cementitious Substrates:
1. Install multiple sheets of metal lath to form continuous plane over substrates.
2. Install with long dimension at horizontal and stagger vertical end laps.
3. Lap horizontal sides not more than 2 in (50 mm), and ensure horizontal edge of upper metal lath laps, or shingles, over lower metal lath.
4. Securely attach metal lath with powder actuated fasteners at following locations:
   a. At each corner.
   b. At midpoint of long side.
   c. At not more than 16 in (400 mm) on centers horizontally and not more than 7 in (175 mm) on centers vertically.
5. Lap vertical ends not more than 2 in (50 mm).
6. Ensure there is lath-to-lath continuity.

C. Installation of Metal Lath at Suspended Ceilings and Soffits:
1. Install multiple sheets of metal lath to form continuous plane over suspended framing.
2. Install with long dimension perpendicular to furring channels and stagger end laps.
3. Lap sides and ends not less than 2 in (50 mm) and securely tie with lath tie wire at not more than 9 in (225 mm) on centers.
4. Securely attach at each carry channel with lath tie wire at not more than 6 in (150 mm) on centers.

3.8 INSTALLING EMBEDDED FLASHINGS

A. Design Intent: Drawings may not necessarily indicate or describe full extent of Work required for completion of embedded flashings.

B. Reglets and Nailers: Install for flashing and other related construction where they are shown to be built into plaster.

C. Preparation: Substrate surfaces shall be smooth and free from projections that could puncture flashing.

D. Flashing Installation:
1. Install true to line and levels indicated; minimize quantity of lap joints by using longest units possible.
2. Set in proper locations with outside hemmed edges flush with building face location indicated; securely attach to substrate with same fasteners as used for attaching metal lath.

3. Terminate ends of horizontal flashings with properly folded and constructed end dams with a depth of not less than 1 in (25 mm), with continuous soldered joints.
4. At lap joints of horizontal flashings, form neat and aligned joints by interlocking splice plate within hemmed edge of sheet metal flashing profile; apply sealant and rubberized asphalt flashing as indicated to create water-resistant joint.

E. Examination and Repair: Immediately prior to plastering Work, examine exposed surfaces of flashing and seal penetrations and damaged areas with rubberized asphalt flashing material before covering.

3.9 INSTALLING MODIFIED CEMENT WATERPROOFING FOR DIRECT BOND PLASTER

A. Application:

1. Apply number of coats recommended by manufacturer, but not less than two, by method suitable for substrate.
2. Thickness of Modified Cement Waterproofing: Total cured nominal thickness of 1/16 in (1.5 mm).
3. Allow sufficient time between coatings to eliminate possibility of cementitious substrate joints telegraphing.
4. Texture final finish to provide keying for subsequent plaster.
5. Allow sufficient time for curing before applying plaster.

3.10 INSTALLING ACCESSORIES

A. General Requirements:

1. Install at locations indicated according to installation quality standard.
2. Attach securely with fasteners to hold accessories in place and alignment during plastering; secure at ends and not more than 12 in (300 mm) on centers.
3. Install longest lengths possible, avoid butt joints.
4. Install so that finished plaster surfaces will be true to line, level, plumb, square, curved or as otherwise required, without excessive thickness of plaster.
5. Set vertical accessories plumb, and horizontal accessories level, and form true and neat corners.
6. Vertical accessories shall pass through horizontal accessories.
7. Miter or cope at corners; install with tight joints seated with sealant and in alignment.
8. Bed accessories in sealant as indicated on Drawings.

B. Casing Beads: Install continuous at edges and terminations of plaster. Use perforated beads at bottom of plaster areas and non-perforated at sides and top.

C. Interior Corners: Install continuous inside corner reinforcement.

D. Exterior Corners: Install continuous outside corner reinforcement.

E. Corners of Openings: Install strip lath reinforcement diagonally.

F. Base of Wall: Install foundation weep screed at dimension above grade indicated.

G. Expansion and Control Joints:

1. Cementitious Substrates: As indicated on Drawings. If not indicated on drawings, then as required to align with joints in substrates behind or below plaster system.
2. Metal Lath over Sheathing Substrates or at Soffits: As indicated on Drawings. If not indicated on drawings, then as follows:

a. Divide plaster into areas (panels) of following maximum sizes with length-to-width ratios of not greater than 2-1/2 to 1:

1) Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
2) Horizontal Surfaces: 100 sq. ft. (9.3 sq. m).

b. Distances between control joints are not to be greater than 18 ft (5.4 m) on centers.
c. At door, window, and other openings, joints are to radiate vertically and horizontally from each corner.

3. Metal Lath over Sheathing Substrates (at Adhered Masonry Veneer Installations): As indicated on Drawings. If not indicated on drawings, then as follows:

a. Distance between Control Joints: 1/2 in (12 mm) wide joints not more than 12 ft (3.6 m) on center each direction and a length-to-width ratio of 3 to 1.

1) Vertical Surfaces: Not more than 144 sq. ft. (13.4 sq. m).
2) Horizontal Surfaces: Not more than 100 sq. ft. (9.3 sq. m).

3.11 INSTALLING PORTLAND CEMENT PLASTER BASE COATS

A. General:

1. Apply plaster by hand or by pneumatic wet gun application method.
2. Establish and follow an application pattern that produces an even drying surface.
3. Avoid using materials that are frozen, caked, lumpy, dirty, or contaminated by foreign materials.
4. Avoid using excessive water in application of plaster materials.
5. Make internal corners and angles square; finish external corners flush with corner beads, square and true with plaster faces.

B. Plaster Base Coats at Direct Bond Locations:

1. Modified Cement Waterproofing: Apply to uniformly cover substrates.
2. Brown Coat: After modified cement waterproofing coat has cured, apply brown coat to uniform thickness with sufficient material and pressure to ensure tight, uniform bond.
3. Thickness of Plaster Base Coat:

a. Brown Coat: 3/8 in (10 mm) thick.

C. Plaster Base Coats at Metal Lath (Wall) Locations:

1. Scratch Coat:

a. Apply to uniform thickness indicated to completely embed metal lath.
b. Uniformly score surface approximately 1/8 in (3 mm) deep.
c. Moist cure each coat in accordance with ASTM C 926 before applying subsequent coatings.

2. Brown Coat:

a. After scratch coat has cured to be sufficient rigid, apply brown coat to uniform thickness indicated over damp scratch coat with sufficient material and pressure to ensure tight, uniform bond.
b. Rod to true, even plane, filling surface defects with plaster.
c. Uniformly float surface.
d. Moist cure each coat in accordance with ASTM C 926 before applying subsequent coatings.

3. Thickness of Plaster Base Coats:

a. Scratch Coat: 3/8 in (10 mm) thick.
b. Brown Coat: 3/8 in (10 mm) thick.

D. Plaster Base Coats at Metal Lath (Soffit) Locations:

1. Scratch Coat:

a. Apply to uniform thickness indicated to completely embed metal lath.
b. Uniformly score surface approximately 1/8 in (3 mm) deep.
c. Moist cure each coat in accordance with ASTM C 926 before applying subsequent coatings.

2. Brown Coat:

a. After scratch coat has cured to be sufficient rigid, apply brown coat to uniform thickness indicated over damp scratch coat with sufficient material and pressure to ensure tight, uniform bond.
b. Rod to true, even plane, filling surface defects with plaster.
c. Uniformly float surface.
d. Moist cure each coat in accordance with ASTM C 926 before applying subsequent coatings.

3. Thickness of Plaster Base Coats:

a. Scratch Coat: 1/4 in (6 mm) thick.
b. Brown Coat: 1/4 in (6 mm) thick.

E. Curing: Moist cure each coat in accordance with ASTM C 926 before applying subsequent coatings.

1. Compensate ambient climatic conditions by providing sufficient moisture in plaster mix to permit continuous hydration of cementitious materials.
2. Allow sufficient time between coats to permit curing and development of sufficient rigidity to resist cracking when subsequent coat is applied.
3. Utilize any of following for curing:

a. Fog spray of water.
b. Vapor barrier over plastered area.
c. Barriers to deflect sunlight and wind.

3.12 INSTALLING PLASTER SYSTEM FOAM TRIM

A. Foam Trim Installation:

1. Attach foam trim over plaster (brown coat) with adhesive.
2. Install foam trim in longest lengths possible.
3. Cut foam trim to fit indicated profiles precisely.
4. Utilize mitered butt joints as much as possible. Abut trim pieces tightly at joints to produce flush, continuously even surfaces without gaps or raised edges between pieces. Fill gaps greater than 1/16 in (1.5 mm) with polystyrene cut to fit gaps exactly inserted without using adhesive.
5. Apply adhesive to back of foam trim coating entire surface of sheathing with adhesive once insulation is adhered. Apply adhesive to a thickness of not less than 1/4 in (6 mm) for factory mixed and not less than 3/8 in (10 mm) for field mixed, measured from surface of insulation before placement.
6. Press and slide foam trim into place. Apply pressure over entire surface to accomplish uniform contact, high initial grab, and an overall level surface.
7. Allow adhered foam trim to remain undisturbed for period recommended by EIFS manufacturer, but not less than 24 hours, before beginning rasping and sanding or applying base coat and reinforcing mesh.

8. Rasp or sand flush surface to remove irregularities projecting more than 1/32 in (0.8 mm) and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 in (1.5 mm).
9. Cut aesthetic reveals in outside face with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce foam trim thickness less than 3/4 in (19 mm).
10. Form joints for sealant application by leaving gaps between adjoining edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
11. Fully wrap board edges with strip reinforcing mesh and extend encapsulating mesh not less than 2-1/2 in (62 mm) over front and back face.
12. Treat exposed edges of insulation as follows:
    a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and subsequent finish.
    b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
13. Interrupt foam trim for expansion joints where indicated.
14. Coordinate flashing installation with installation of foam trim to produce a wall system that does not allow water to penetrate.

B. EIFS Weatherproof Base Coat Installation:

1. Apply base coat in 2 application's to exposed surfaces of foam trim in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16 in (1.5 mm) dry coat total thickness.
2. Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 in (62 mm) or otherwise treated at joints. Do not lap reinforcing mesh within 8 in (200 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
3. Where indicated, to obtain higher impact resistance apply second base coat and second layer of reinforcing mesh, in same manner as first application. Do not apply until first base coat has cured.

3.13 INSTALLING FINISH COAT

A. Textured Acrylic Coating Finish Coat: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

B. Integrally-Colored Cement Plaster Finish Coat:

1. Apply to 1/8 in (3 mm) thickness to provide finish complying with one of following:
    a. PCA "Portland Cement Plaster/Stucco Manual", Fifth Edition: Fine sand float.
    b. Technical Services Information Bureau (tsib.org): Fine sand float.
2. Thickness: 1/8 in (3 mm).
3. Curing: Cure with same criteria as specified for base coats.

3.14 PLASTERING SYSTEM THICKNESSES

A. Plastering at Direct Bond Locations:

1. Total System Thickness: 5/8 in (15 mm) thick.

B. Plastering at Metal Lath (Wall) Locations:

1. Total System Thickness: 7/8 in (21 mm) thick.

C. Plastering at Metal Lath (Soffit) Locations:

1. Total System Thickness: 5/8 in (15 mm) thick.

3.15 TOLERANCES

A. Finish Plane: Do not deviate more than plus or minus 1/8 in per 10 ft (3 mm per 3 m) from a true plane in finished plaster surfaces, as measured by a 10 ft (3 m) straightedge placed on surface.

3.16 FIELD QUALITY CONTROL

A. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor’s expense.

1. Refer to Owner's Building Enclosure Commissioning Plan for Field Observations and Performance Testing Activities.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.17 ADJUSTING

A. Patching: Cut, patch, repair, and point-up Portland cement plaster as necessary to accommodate other Work. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces.

B. Imperfections: Repair or replace Work to eliminate cracks, dents, blisters, buckles, crazing, check cracking, dry outs, efflorescence, sweat outs, excessive pinholes, and similar imperfections and where bond to substrate has failed.

3.18 FINISH SCHEDULE

A. Finish System Color and Texture: As selected by Architect from manufacturer's full range of available standard and custom colors and textures.

B. TAC01 - Textured Acrylic Coating Finish System Color and Texture:

1. Manufacturer:
2. Product Series:
3. Color Name and Number:
4. Face Texture: Smooth.
5. Face Texture: Fine.
6. Face Texture: Coarse.

C. Intergrally Colored Cement Plaster Finish Coat:

1. Basis of Design Color and Texture Selection:

a. Manufacturer:
b. Product Series:
c. Color Name and Number:
d. Face Texture:

2. Basis of Design Color and Texture Selection: As selected by Architect from manufacturer's full range of available standard and custom colors and textures.

END OF SECTION

SECTION 092900
GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Gypsum board assemblies and supplementary items necessary for installation.

1. Grid suspension systems for ceilings.
2. Channel framed suspension systems for ceilings.
3. Metal framing systems for interior partitions.
4. Interior gypsum board and tile backing panels.
5. Gypsum board accessories and finishing systems.

1.2 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 Standard Terminology Related to Gypsum and Related Building Materials and Systems for definitions of terms not defined in this Section or in other referenced quality standards.

B. Damage: Stored or installed gypsum board materials shall be classified as defective and nonconforming Work if they have been exposed to wetness or dampness at any time prior to Substantial Completion or if they exhibit evidence of active or dormant mold or mildew.

C. Concentrated Loads: Wall or partition mounted equipment, wall finishes, stone facings, lead lined doors and frames, or ornamentation exceeding 15 lbs/sf uniform load, 75 lb. point load, or 50 lb/ lf lineal load.

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

   a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

B. Project Framing Analysis: Analyze each framing condition for design loads indicated in performance requirements.

1. Provide framing products in sizes and thicknesses required to meet or exceed the criteria based on project loads, spans and in-service conditions.
2. Material Quality Standard for Metal Framing Components: Provide components of sizes indicated but not less than that required to comply with ASTM C 754 for conditions indicated.

C. Gypsum Board Assemblies Supporting Concentrated Loads - Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems required to support concentrated loads including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following.

1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.

D. Gypsum Board Assemblies Withstanding Seismic Loads - Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems required to withstand seismic loads including attachment to building structure required to meet design intent of Contract Documents including, but not limited to, the following.

1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings:

1. Include scaled and dimensioned drawings showing locations of control joints.
2. Gypsum Board Location Schedule: Provide detailed schedule in format similar to "Gypsum Board Schedule" at end of this Section indicating gypsum board products to be installed and their respective locations.
3. Guestrooms Layout: Provide metal stud framing layout for Guestrooms, including but not limited to stud gauge, placement and dimensions.

C. Shop Drawings for Engineered Gypsum Board Assemblies - Concentrated Loads: Scaled and dimensioned drawings showing locations, fabrication, and installation of gypsum board assemblies required to support concentrated loads, including plans, elevations, sections, details

of components, and attachments to building structure; include seal and signature of delegated engineering professional responsible for their preparation.

D. Shop Drawings for Engineered Gypsum Board Assemblies - Seismic Loads: Scaled and dimensioned drawings showing locations, fabrication, and installation of gypsum board assemblies required to withstand seismic loads, including plans, elevations, sections, details of components, and attachments to building structure; include seal and signature of delegated engineering professional responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Preconstruction Test Reports for Acoustical Sealant: Compatibility test reports from sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility with sealants; include sealant manufacturer's certification of test results for sealant compatibility and recommendations for primers and substrate preparation needed to obtain adhesion and prevent corrosion of substrate.

1.6 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Certification of framing members in accordance with the product-certification program of the Steel Framing Industry Association (SFIA) or a similar organization that provides a verifiable code-compliance program.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.
   b. Field Samples for Gypsum Board Finishing: Build 10 ft (3 m) square gypsum board (attached to metal studs) area for each finish level specified. Include not less than one tapered-to-tapered edge gypsum board joint and cut edge-to-cut edge gypsum board joint.

2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Protect accepted mock-up from the elements with weather-resistant membrane.
6. Obtain Architect's acceptance of mockups before starting fabrication.
7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
8. Acceptance of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

1.9 PROJECT CONDITIONS

A. Environmental Conditions: Comply with ASTM C 840 requirements or respective gypsum board manufacturer’s written recommendations, whichever are more stringent.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Movement: Withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads established by authorities having jurisdiction.

1. Live Load Deflection: Accommodate differential vertical deflection of floors:

a. Deflection: As indicated on Drawings.

C. Seismic Performance: Withstand the effects of earthquake motions determined in accordance with local building code and authorities having jurisdiction.

D. Horizontal Deflection: For composite and non-composite wall assemblies, limited to deflections and horizontal loading indicated in Metal Framing Schedule.

E. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E119 / NFPA 251 / UL 263, and displaying a classification label from an independent testing agency acceptable to authorities having jurisdiction.

1. Construct fire-resistance-rated partitions in compliance with tested assembly requirements indicated on Drawings.
2. Rated assemblies to be substantiated from applicable testing using proposed products, by Contractor.
3. Independent Testing Agencies as evidenced by design designation included in approval manual.

a. UL - "Fire Resistance Directory", Category BXUV.
b. GA 600 - "Fire Resistance Design Manual".
c. Other agencies acceptable to authorities having jurisdiction.

F. Smoke-Resistance-Rated Assemblies: For smoke-resistance-rated assemblies, provide materials and construction identical to those tested in accordance with fire-resistance-rated assemblies by an independent testing agency acceptable to authorities having jurisdiction.

G. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

H. Dimensional Tolerances: Provide products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

A. Suspension System:

1. Material Quality Standard: ASTM C 645, heavy-duty rating.
2. Description: Manufacturer's standard direct-hung suspended grid system composed of main beams and cross furring .members that interlock to form a modular supporting network for application of gypsum board.
3. Protective Coating - Standard Applications: ASTM A 653/A 653M, not less than G40 (Z120), hot-dip galvanized coating, unless otherwise indicated.
4. Protective Coating - High Moisture / Humidity Applications: ASTM A 653 / A 653M, G90 (Z275) hot-dip galvanized coating at high moisture areas such as Kitchens, Saunas, Steam Rooms, and Pool Enclosures.
5. Main Beams: Inverted T-shaped profile of single or double mounting flange; minimum 1-1/2 in (38 mm) profile height with top bulb and minimum 1-3/8 in (35 mm) wide knurled mounting flange; factory punched for hanger wire, and to receive cross furring members.

6. Cross Furring Members:
   a. Tees: Inverted T-shaped profile of single or double mounting flange; 1-1/2 in (38 mm) profile height with top bulb and minimum 1-3/8 in (35 mm) wide knurled mounting flange; with ends formed for positive interlocking with main beam.
   b. Channels: Inverted hat shaped profile; minimum 7/8 in (21 mm) profile height and minimum 1-3/8 in (35 mm) wide knurled mounting flange; with ends formed for positive interlocking with main beam.
7. Wall Angle: Angle shaped profile with each leg not less than 1-1/4 in (32 mm).
8. Curved Members: Where curved ceilings are indicated, members shall be rolled by manufacturer; field fabricated curved members not permitted.
9. Accessories: Specifically designed as an integral part of suspended grid system.
10. Manufacturers and Products:
    a. Armstrong World Industries Inc.; Drywall Grid System.
    b. Chicago Metallic Corporation; 650-C/670-C Fire-Rated Drywall Grid System.
    c. United States Gypsum Company (USG Interiors, Inc.); Drywall Suspension System.

B. Hanger Attachments to Concrete:
1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
   a. Cast-in-place anchor, designed for attachment to concrete.
   b. Post-installed chemical anchor.
   c. Post-installed expansion anchor.
2. Powder-Actuated Fasteners: Suitable for application indicated, ANSI A 10.3; low velocity, powder-actuated fasteners; drive pins and clip angles fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
3. Manufacturers:
   a. Construction Materials, Inc.
   b. Heckman Building Products, Inc.
   c. Hilti Corp.
   d. ITW Ramset/Red Head.
   e. Powers Fasteners.
   f. Simpson Strong Tie Anchor Systems.
4. For post-tensioned concrete, anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

C. Wire:
1. Material Quality Standard: ASTM A 641 / A 641M, Class 1, zinc-coated, soft annealed, mild steel wire.
2. Tie Wire Minimum Size: Single 0.0625 in (16 gage) (1.6 mm) diameter strand, or double 0.0475 in (18 gage) (1.2 mm) diameter strands. Preformed furring channel clips are acceptable.
3. Hanger Wire Minimum Size: 0.1620 in (8 gage) (4.12 mm) diameter.

D. Rod Hangers: ASTM A 1008 / A 1008M, 7/32 in (0.56 mm) diameter mild carbon steel rod, with primer painted finish.

E. Flat Hangers: ASTM A 1008 / A 1008M, 1 in by 3/16 in (25 mm by 5 mm) by length indicated or required, with primer painted finish.

F. Angle Hangers: ASTM A 36 / A 36M, rolled steel angle, 2 in by 2 in (50 mm by 50 mm), with primer painted finish.

2.5 SUSPENDED CHANNEL FRAMED SYSTEM FOR INTERIOR CEILINGS

A. Material Quality Standard: Provide components of sizes indicated but not less than that required to comply with ASTM C 754 for conditions indicated.

B. Protective Coating - Standard Applications: ASTM A 653/A 653M, not less than G40 (Z120), hot-dip galvanized coating, unless otherwise indicated.

C. Protective Coating - High Moisture / Humidity Applications: ASTM A 653 / A 653M, G90 (Z275) hot-dip galvanized coating at high moisture areas such as Kitchens, Saunas, Steam Rooms, and Pool Enclosures.

D. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.

   a. Cast-in-place anchor, designed for attachment to concrete.
   b. Post-installed chemical anchor.
   c. Post-installed expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, ANSI A10.3; low velocity, powder-actuated fasteners; drive pins and clip angles fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

3. Manufacturers:

   a. Construction Materials, Inc.
   b. Heckman Building Products, Inc.
   c. Hilti Corp.
   d. ITW Ramset/Red Head.
   e. Powers Fasteners.
   f. Simpson Strong Tie Anchor Systems.

4. For post-tensioned concrete, anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

E. Wire:

1. Material Quality Standard: ASTM A 641 / A 641M, Class 1, zinc-coated, soft annealed, mild steel wire.
2. Tie Wire Minimum Size: Single 0.0625 in (16 gage) (1.6 mm) diameter strand, or double 0.0475 in (18 gage) (1.2 mm) diameter strands.
3. Hanger Wire Minimum Size: 0.1620 in (8 gage) (4.12 mm) diameter.

F. Compression Struts: Metal framing section with L/R ratio of 200 maximum and formed from galvanized sheet steel; with bolted connections with 5/16 in (8 mm) diameter bolts.

G. Carrying Channels: Cold-rolled, commercial grade galvanized sheet steel, 0.0538 in (16 gage) (1.3 mm) minimum uncoated base metal thickness; 1/2 in (12 mm) wide flanges by 1-1/2 in (38 mm) deep.

H. Furring Channels: Cold-rolled, commercial grade galvanized sheet steel, 0.0283 in (22 gage) (0.72 mm) minimum uncoated base metal thickness; inverted hat shaped profile; minimum 7/8 in (21 mm) profile height and minimum 1-3/8 in (35 mm) wide knurled mounting flange.

2.6 FRAMING SYSTEMS

A. Project Framing Analysis: Analyze each framing condition for design loads indicated in performance requirements.

1. Provide framing products in sizes and thicknesses required to meet or exceed the criteria based on project loads, spans and in-service conditions.

B. Framing Members, General: Comply with ASTM C645 and AISI S220 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 and AISI S220 requirements for metal unless otherwise indicated.
2. Protective Coating - Standard Applications: ASTM A 653/A 653M, not less than G40 (Z120), hot-dip galvanized coating or coating with equivalent corrosion resistance, unless otherwise indicated.

a. Equivalent Protective Coatings: Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

3. Protective Coating - High Moisture / Humidity Applications: ASTM A 653 / A 653M, G90 (Z275) hot-dip galvanized coating or coating with equivalent corrosion resistance at high moisture areas such as Kitchens, Saunas, Steam Rooms, and Pool Enclosures.

a. Equivalent Protective Coatings: Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

C. Metal Studs and Floor Track (Runners):

1. Metal Framing Components for Typical Partitions:

a. Stud Description: C-shaped members formed from galvanized sheet steel with 1 1/4 in (32 mm) flange edges bent back 90 degrees and doubled over to form 13/64 in (5 mm) wide minimum return lip; of web depth indicated on Drawings and uncoated base metal thickness indicated in “Metal Framing Schedule” at end of this Section; with web punchouts.

1) Alternative Jamb Stud Members - Contractor’s Option: "Heavy Duty" or "King" studs; C-shaped members formed from galvanized sheet steel with 3 in (75 mm) flange width; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section.

b. Track (Runner) Description: U-shaped members formed from galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.

1) Floor Track (Runner): 1-1/4in (32 mm).
2) Top of Wall Track (Runner): 3 in (75 mm).

2. Metal Framing for Shaftwall Partitions:

a. Stud Description: C-H, double E, C-T, or I-shaped members formed from galvanized sheet steel; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.
b. Track (Runner) and Jamb Description: J-shaped track or jamb members formed from galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.

3. Equivalent Products - Deformed Metal Studs and Tracks (Runners):

a. Equivalent Gauge Thickness (EQ) Steel Studs and Runners Evaluation Criteria: Certified third-party testing with gypsum board in accordance with ICC-ES AC86 indicating compliance with requirements.
b. Material Quality Standard: ASTM A 1003 / A 1003M sheet steel with galvanized coating.
c. Stud Description: C-shaped members formed from deformed surface galvanized sheet steel with 1-1/4 in (32 mm) flange edges bent back 90 degrees and bent again to form 3/16 in (5 mm) wide minimum return lip; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.
d. Track (Runner) Description: U-shaped members formed from deformed surface galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.
e. Manufacturer and Product: ClarkDietrich Building Systems; ProSTUD.

D. Flat Straps and Back-Up Plates: Galvanized sheet steel for blocking and bracing in length and width indicated, of same uncoated base metal thickness as adjacent metal studs.

E. Bridging:

1. Channel: U-shaped members formed from galvanized sheet steel not less than 0.0566 in (16 gage) (1.44 mm) minimum uncoated base metal thickness, with 1/2 in (12 mm) flanges and depth fitting stud punchouts.
2. Clip Angle: 1-1/2 in by 1-1/2 in (38 mm by 38 mm) L-shaped members formed from galvanized sheet steel not less than 0.0713 in (14 gage) (1.81 mm) uncoated base metal thickness.

F. Rigid Furring Channels: Hat-shaped members formed from galvanized sheet steel not less than 0.0312 in (20 gage) (0.78 mm) minimum uncoated base metal thickness; 7/8 in (21 mm) depth and minimum 1-3/8 in (35 mm) wide knurled mounting flange.

G. Resilient Furring Channels: 1/2 in (12 mm) deep members formed from galvanized sheet steel not less than 0.0283 in (22 gage) (0.72 mm) minimum bare-metal thickness, designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

H. Sound Isolation Clips: Uni-body molded rubber and galvanized steel mount designed to receive standard galvanized steel furring channels.

1. Basis of Design: Pliteq; GenieClip RST.

I. Sound Isolation Ceiling Hangers:

1. Resilient Sound Isolation Bracket: Molded rubber isolator and steel hanger bracket designed to receive ceiling suspension system wire ties.

a. Basis of Design: Pliteq; GenieClip LB Resilient Sound Isolation Bracket.

2. Spring Isolation Hanger: Spring hanger with channel clip designed to receive gypsum board furring/framing assembly.

a. Basis of Design: Kinetics Noise Control; ICC Deck Suspended Ceiling Hanger.

J. Framing Accessories for Spanning Multiple Floors: Framing manufacturers standard connectors, bracings, brackets, clips, gussets, and other framing devices as required by conditions, formed from galvanized sheet steel complying with requirements of main support system.

K. Z-Shaped Furring: Members formed from galvanized sheet steel not less than 0.0283 in (22 gage) (0.72 mm) minimum bare-metal thickness, with slotted or non-slotted web, face flange of 1-1/4 in (32 mm), wall attachment flange of 7/8 in (21 mm); depth required to fit insulation thickness indicated.

L. Pony Wall Framing Connection: ASTM A36 hot rolled steel base plate, Structural Grade 50 Type H Stud connector designed to support cantilevered partial wall systems.

1. Basis of Design: ClarkDietrich; Pony Wall.

M. Manufacturers:

1. Building Products Division of Consolidated Fabricators Corp.
2. California Expanded Metal Products Co. (CEMCO).
3. ClarkDietrich Building Systems
4. Marino Ware; Division of Ware Industries.
5. MBA Metal Framing.
6. Scafco Corp.

N. Heavy-Duty Framing Systems (HDS) Headers and Jambs at Lead Lined Doors: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges and as follows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Heavy Duty Studs - HDS and Header Bracket - HDSC and accessories as required for a complete installation.

a. Minimum Base-Steel Thickness: 0.0538 inch (1.37 mm) or as indicated on drawings.
b. Web and Flange Widths, Type HDS: 3-5/8 by 3 by 1-1/16 by 3/4 inch (92.1 by 76.2 by 27.0 by 19.1 mm) or 6 by 3 by 2-1/4 by 3/4 inch (152 by 76.2 by 57.2 by 19.1 mm); as indicated on drawings.
c. Web and Flange Widths, Type HDSC: 3-1/2 by 3-1/16 by 2 inches (88.9 by 77.8 by 50.8 mm) or 5-7/8 by 3-1/16 by 2 inches (149 by 77.8 by 50.8 mm); as indicated on drawings.

2. Slip-Type Head Joints: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing for vertical movement.

a. Basis of Design: ClarkDietrich Building Systems; Fast Top Clip FTC3 or FTC5.

3. Anchor Clips: Pre-punched, galvanized anchor clips designed for use in floor n conditions that provide a positive attachment of studs to runners while allowing for horizontal, torsional and vertical (uplift) loads.

a. Basis of Design: ClarkDietrich Building Systems; EasyClip T-Series, T685 or T683.

2.7 PRE-ENGINEERED METAL FRAMING COMPONENTS

A. Deflection and Firestop Track (Runner):

1. Description: Proprietary track (runner) formed from galvanized sheet steel manufactured to accommodate movement of building structure without transferring stress to partition (to prevent cracking of gypsum board resulting from deflection of building structure above) while maintaining continuity of fire resistance rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
2. Manufacturers:

a. Metal Stud Framing Manufacturer.
b. Fire Trak Corp.
c. The Steel Network.

B. Flexible Track (Runner):

1. Description: Proprietary track (runner) formed from galvanized sheet steel manufactured to be flexible and adjustable to fit design requirements; in thickness not less than indicated for studs and in width to accommodate depth of studs.
2. Manufacturers:

a. Metal Stud Framing Manufacturer.
b. Accu-Arc Curved Wall Products.
c. Flex-Ability Concepts.
d. Radius Track Corp.

C. Headers:

1. Description: Proprietary header assembly formed from galvanized sheet steel manufactured to bear partition load above openings without transferring stress to partition (to prevent cracking of gypsum board); in thickness not less than indicated for studs and in width to accommodate depth of studs.
2. Manufacturers:

a. Metal Stud Framing Manufacturer.
b. Brady Construction Innovations, Inc.

2.8 GYPSUM BOARD PRODUCTS

A. Sizes: Maximum lengths and widths available that will minimize short edge-to-short edge butt joints and to correspond to support system indicated.

B. Typical Paper-Faced Gypsum Board Products:

1. Paper-Faced Type X Gypsum Board:

a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
b. Description: Noncombustible fire resistant gypsum core with paper surfacing on face, back, and long edges; tapered long edges; 5/8 in (15 mm) thick.
c. Manufacturers and Products:

1) American Gypsum Company; FireBloc Type X Gypsum Board.
2) CertainTeed Corporation; Type X Gypsum Board.
3) Georgia-Pacific Gypsum LLC; ToughRock Fireguard Gypsum Board.
4) National Gypsum Company; Gold Bond Fire-Shield Gypsum board.
5) United States Gypsum Company (USG); Sheetrock Firecode Core.

2. Sustainable Paper-Faced Type X Gypsum Board: At Contractors option, provide sustainable paper-faced Type X gypsum board or typical paper-faced Type X gypsum board.

   a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
   b. Description: Noncombustible fire resistant gypsum core with paper surfacing on face, back, and long edges; tapered long edges; 5/8 in (15 mm) thick. UL Type Designation ULIX or FSLX.

      1) ISO 14040 Environmental Management, Life Cycle Assessment, Principles and Framework:

         a) Carbon emissions per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard with a manufacturing Global Warming Potential of 317.4 kg CO2-eq./1000MSF.
         b) Water reduction per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard having net use of fresh water value of 1.329 m3/1000 ft2.
         c) Primary Energy from non-renewable resources per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard have a value of 5,291 MJ/1000 ft2.

   c. Manufacturers:

      1) United States Gypsum Company, LLC, USG Sheetrock Brand EcoSmart Panels Firecode X.
      2) National Gypsum Company; Gold Bond EVOLVE X Gypsum Board.

3. Paper-Faced Type C Gypsum Board:

   a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
   b. Description: Noncombustible fire resistant gypsum core, with additives to enhance fire resistance, with paper surfacing on face, back, and long edges; tapered long edges; 5/8 in (15 mm) thick.
   c. Manufacturers and Products:

      1) American Gypsum Company; FireBloc Type C Gypsum Board.
      2) CertainTeed Corporation; Type C Gypsum Board.
      3) Georgia-Pacific Gypsum LLC; ToughRock Fireguard C Gypsum Board.
      4) United States Gypsum Company (USG); Sheetrock Firecode C Core Gypsum Panels.

4. Paper-Faced Acoustically Enhanced Gypsum Board:

   a. Description: Noncombustible gypsum core, with polymer sound dampening sheet in center, with paper surfacing on face, back and long edges; tapered long edges; 5/8 in (15 mm) thick.
   b. Manufacturers and Products:

      1) CertainTeed Corporation; SilentFX Acoustical Gypsum Board.
      2) National Gypsum Company; Gold Bond SoundBreak Gypsum Board.
      3) PABCO Gypsum; QuietRock ES.

5. Paper-Faced Flexible Gypsum Board at Curved Surfaces:

   a. Material Quality Standard: ASTM C 1396 / C 1396M.
   b. Description: Gypsum core with paper surfacing on face, back and long edges; manufactured to bend to fit tight radii and be more flexible than typical panels without wetting; tapered long edges; 1/4 in (6 mm) thick.

c. Manufacturers and Products:

1) American Gypsum Company; 1/4" ClasicRoc Gypsum Board.
2) CertainTeed Corporation; 1/4" Flex Gypsum Board.
3) Georgia-Pacific Gypsum LLC; ToughRock FlexRoc Gypsum Board.
4) National Gypsum Company; Gold Bond High Flex Brand Gypsum board.
5) United States Gypsum Company (USG); Sheetrock 1/4" Flexible Gypsum Panels.

C. Moisture-Resistant Gypsum Board Products:

1. Moisture-Resistant Paper-Faced Gypsum Board:

a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core, with moisture-resistant paper surfacing on face, back and long edges; tapered long edges; score of 10 according to ASTM D 3273; 5/8 in (15 mm) thick.
c. Manufacturers and Products:

1) American Gypsum Company; M-Bloc Mold and Moisture Resistant Type X Gypsum Board.
2) CertainTeed Corporation; M2Tech Moisture and Mold Resistant Type X Gypsum Board.
3) National Gypsum Company; Gold Bond XP Gypsum Board.
4) United States Gypsum Company (USG); Sheetrock Mold Tough Firecode Gypsum Board.

2. Moisture-Resistant Paperless Glass-Mat Gypsum Board:

a. Material Quality Standard: ASTM C 1658 / C 1658M.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on both faces; square edges; score or 10 according to ASTM D 3273; 5/8 in (15 mm) thick.
c. Manufacturers and Products:

1) Georgia-Pacific Gypsum LLC; DensArmor Plus Fireguard Interior Guard.
2) National Gypsum Company; eXP Interior Extreme Gypsum Panels.

3. Moisture-Resistant Paper-Faced Shaft-Liner Gypsum Board:

a. Material Quality Standard: ASTM C 1396/C 1396M, Type X.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core with moisture-resistant paper surfacing on face, back and long edges; tapered long edges; score of 10 according to ASTM D 3273; 1 in (25 mm) thick.
c. Manufacturers and Products:

1) American Gypsum Company; M-Bloc Shaft Liner Panels.
2) CertainTeed Corporation; M2Tech Moisture & Mold Resistant Shaftliner.
3) National Gypsum Company; Gold Bond 1 Fire-Shield Shaftliner XP.
4) USG Corp.; SHEETROCK Mold Tough Gypsum Liner Panels.

4. Moisture-Resistant Paperless Glass-Mat Shaft-Liner Gypsum Board:

a. Material Quality Standard: ASTM C 1658 / C 1658M.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on both faces, double bevel long edges; score of 10 according to ASTM D 3273; 1 in (25 mm) thick.
c. Manufacturers and Products:

1) American Gypsum Company; M-Glass Shaft Liner Panels.

2) CertainTeed Corporaton; GlasRoc Shaftliner Type X.
3) Georgia-Pacific Gypsum LLC; DensGlass Shaftliner.
4) National Gypsum Company; eXP Extended Exposure Shaftliner.
5) USG Corp.; SHEETROCK Glass-Mat Liner Panels

5. Moisture-Resistant Coated Glass-Mat Gypsum Board Products (Tile Backing Panel):

a. Material Quality Standard: ASTM C 1178 / C 1178M.
b. Description: Enhanced moisture-resistant, noncombustible, gypsum core with inorganic, embedded fiberglass mat on both sides; outside face coated with heat-cured copolymer water-resistant coating; square edges; score or 10 according to ASTM D 3273; 5/8 in (15 mm) thick.
c. Manufacturers and Products:

1) CertainTeed Corporation; GlasRoc Tile Backer.
2) Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
3) National Gypsum Company; eXP Tile Backer.
4) USG; Durock Brand Glass-Mat Tile Backerboard.

6. Moisture-Resistant, Abuse-Resistant Gypsum Board Products:

a. Material Quality Standard: ASTM C 1629 (C 1629M), Type X, and as follows:

1) Soft Body Impact Test: ASTM E 695, Classification Level 2.
2) Hard Body Impact Test: Annex A1, Classification Level 1.
3) Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

b. Paper-Faced Products: Specially formulated, noncombustible, gypsum core with heavy liner paper on back and smooth, heavy abrasive-resistant face paper on face and long edges; manufactured to produce greater resistance to surface indentation and through-penetration than typical gypsum panels; tapered long edges; 5/8 in (15 mm) thick.

1) Manufacturers and Products:

a) National Gypsum Company: Gold Bond Hi-Abuse XP Gypsum Board.

c. Paperless Products: Specially formulated, noncombustible, gypsum core with coated, fiberglass mat on both faces; manufactured to produce greater resistance to surface indentation and through-penetration than typical gypsum panels; tapered long edges; 5/8 in (15 mm) thick.

1) Manufacturers and Products:

a) National Gypsum Company; Gold Bond eXP Interior Extreme AR Gypsum Panel.
b) USG Corporation; Fiberock Interior Panel, Abuse Resistant.

7. Moisture-Resistant, Impact-Resistant Gypsum Board Products for Elevator Hoistway Enclosures and Stairwells:

a. Material Quality Standard: ASTM C 1629 (C 1629M), Type X, and as follows:

1) Soft Body Impact Test: ASTM E 695, Classification Level 2.
2) Hard Body Impact Test: Annex A1, Classification Level 3.
3) Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

b. Paper-Faced Products: Specially formulated, noncombustible, gypsum core with heavy liner paper on back and smooth, heavy abrasive-resistant face paper on

face and long edges; manufactured to produce greater resistance to surface indentation and through-penetration than typical gypsum panels; tapered long edges; 5/8 in (15 mm) thick.

1) Manufacturers and Products:

a) National Gypsum Company: Gold Bond Hi-Impact XP Gypsum Board.

c. Paperless Products: Specially formulated, noncombustible, gypsum core with coated, fiberglass mat on both faces; manufactured to produce greater resistance to surface indentation and through-penetration than typical gypsum panels; tapered long edges; 5/8 in (15 mm) thick.

1) Manufacturers and Products:

a) USG Corporation; Fiberock Panels, VHI Abuse-Resistant.

d. Locations: As indicated on the Drawings and as follows.

1) Elevator Hoistway Enclosures and Stairwells.
2) Fire Service Access Elevator Hoistways Enclosures.

8. Moisture-Resistant, Impact-Resistant Gypsum Board Products:

a. Material Quality Standard: ASTM C 1629 (C 1629M), Type X, and as follows:

1) Soft Body Impact Test: ASTM E 695, Classification Level 3.
2) Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

b. Paper-Faced Products: Specially formulated, noncombustible, gypsum core with heavy liner paper on back and smooth, heavy abrasive-resistant face paper on face and long edges; manufactured to produce greater resistance to surface indentation and through-penetration than typical gypsum panels; tapered long edges; 5/8 in (15 mm) thick.

1) Manufacturers and Products:

a) National Gypsum Company: Gold Bond Hi-Impact XP Gypsum Board.

c. Paperless Products: Specially formulated, noncombustible, gypsum core with coated, fiberglass mat on both faces; manufactured to produce greater resistance to surface indentation and through-penetration than typical gypsum panels; tapered long edges; 5/8 in (15 mm) thick.

1) Manufacturers and Products:

a) Georgia-Pacific Gypsum LLC; Dens Armor Plus Impact-Resistant Interior Panels.
b) National Gypsum Company; Gold Bond eXP Interior Extreme IR Gypsum Panel.
c) USG Corporation; Fiberock Panels, VHI Abuse-Resistant.

2.9 CEMENTITIOUS BOARDS

A. Cementitious Backer Units:

1. Material Quality Standard: ANSI A118.9 or ASTM C 1325.
2. Description: Cementitious panels composed of Portland cement, aggregates, glass mesh on both faces, and manufacturer's proprietary ingredients; capable of remaining unaffected by prolonged exposure to water; 1/2 in (12 mm) thick.
3. Manufacturers and Products:

a. Custom Building Products; WonderBoard.
b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
c. National Gypsum Company.

1) Straight: PermaBase Cement Board.
2) Curved: PermaBase Flex Cement Board.

d. United States Gypsum Company (USG); DUROCK Interior Cement Board.

2.10 TRIM ACCESSORIES

A. Typical Drywall Trim Accessories:

1. Material Quality Standard: ASTM C 1047.
2. Description: Trim profile fabricated of galvanized steel sheet; of size suitable for gypsum board thickness; with recessed, perforated flange formed to receive joint compound.
3. Trim Products:

a. Cornerbead:

1) Purpose: For protecting outside (external) corners.
2) Basis of Design: United States Gypsum Company (USG); Dur-A-Bead Corner Bead, 103.

b. Optional Equivalent Products – Structural Laminate Cornerbead System: At Contractor's option, provide high strength tapered co-polymer core cornerbead with tight fibered paperboard facing and joint tape paper backing.

1) Purpose: For protecting outside (external) corners.
2) Basis of Design: Structus Building Technologies; No-Coat Structural Laminate Drywall Corner System.

c. LC-Bead (J-Bead):

1) Purpose: For protecting exposed edges of gypsum board where back flange can be used.
2) Basis of Design: United States Gypsum Company (USG); J-Trim, 200-A.

d. L-Bead:

1) Purpose: For protecting exposed edges of gypsum board where back flange cannot be used.
2) Basis of Design: United States Gypsum Company (USG); L-Trim, 200-B.

e. J-Stop:

1) Purpose: For protecting edges of gypsum board that does not require finishing.
2) Basis of Design: United States Gypsum Company (USG); J-Stop, 402.

f. Control Joint:

1) Description: One-piece trim formed with V-shaped slot, with removable strip covering slot opening.
2) Purpose: For conditions requiring expansion and contraction stresses of large areas of gypsum board to be relieved.
3) Basis of Design: United States Gypsum Company (USG); Control Joint, 093.

g. Control Joint - Fire Rated:

1) Description: One-piece trim formed with V-shaped slot and intumescent tape factory applied to one side of back of control joint, with removable strip covering slot opening.
2) Purpose: For conditions requiring expansion and contraction stresses of large areas of gypsum board to be relieved at fire rated partitions.
3) Basis of Design: Clark Dietrich; Fire Rated Control Joint.

h. Other Trim or Special Shapes: Products as required by condition.

4. Manufacturers:

a. Dietrich Industries, Inc.; Unimast.
b. Fry Reglet Architectural Metals.
c. Marino Ware; Division of Ware Industries.
d. Niles Building Products Co.
e. Superior Metal Trim; Division of Delta Star, Inc.
f. United States Gypsum Company (USG).

B. Plastic Drywall Trim Accessories:

1. Description: Trim profile fabricated of high-impact PVC, of size suitable for gypsum board thickness; with recessed, perforated flange formed to receive joint compound.
2. Trim Products Profiles: As listed above in "Typical Drywall Trim Accessories".
3. Manufacturers:

a. Alabama Metal Industries Corporation; a Gibraltar Industries Company.
b. Phillips Manufacturing Co.
c. Plastic Components, Inc.
d. Trim Tex Drywall Products.
e. Vinyl Corp., a division of ClarkDietrich Building Systems.

C. Accent Trim Accessories:

1. Description: Extruded aluminum accessories of profiles and dimensions indicated of alloy and temper with not less than strength and durability properties of ASTM B 221, alloy 6063-T5.
2. Basis of Design:

a. Aluminum Trim Accessory - Drawing Designation AT1:

1) Manufacturer: Fry Reglet
2) Product: DMCT-1250 Corner Trim Molding
3) Dimension: 1-1/2 x 1-1/2-inch.
4) Finish: Clear anodized.

b. Aluminum Trim Accessory - Drawing Designation AT2:

1) Manufacturer: Fry Reglet.
2) Product: DMCT-375
3) Dimension: 3/8 x 3/8-inch.
4) Finish: Clear anodized.

c. Aluminum Trim Accessory - Drawing Designation ATx:

1) Manufacturer:
2) Product:
3) Reveal Dimension:
4) Finish:

3. Manufacturers:

a. Fry Reglet Architectural Metals.
b. Gordon, Inc.
c. Pittcon Industries.

D. Partitions to Glazed Aluminum Framing Trim Accessories:

1. Partition and Mullion Gap Closure:

a. Description: Pre-assembled, spring loaded, partition gap closure fabricated from extruded aluminum with sound attenuating mineral wool insulation, compressible foam between extrusion and interior face of glass and acoustical sealant.
b. Manufacturers and Products:

1) Basis of Design: Gordon; Mullion Mate Series 30, Series 40 or Series 60.
2) STC Rating: Not less than Partition STC Rating; refer to Partition Types.
3) Finish: As selected by Architect to match mullion finish, unless indicated otherwise.

2. Sound Barrier Mullion Trim Cap (Demising Partitions between Units):

a. Description: Custom sound barrier mullion trim cap fabricated from window mullion jamb extensions filled with sound attenuating mineral wool insulation, compressible foam between extrusion and interior face of glass, fire containment sealant and acoustical sealant. Mullion trim cap shall engage end of partition and cover mullion with profiles indicated on Drawings, width as required for each condition.

1) Basis of Design: Custom configuration as indicated on Drawings.
2) Finish: As selected by Architect to match mullion finish, unless indicated otherwise.

3. Proprietary Sound Barrier Mullion Trim Cap (Demising Partitions between Units):

a. Description: Sound barrier mullion trim cap fabricated from extruded aluminum with sound attenuating foam, compressible foam between extrusion and interior face of glass and acoustical sealant.
b. Manufacturers and Products:

1) Basis of Design: Mull-it-Over Products; 55 Classic Mullion Trim Cap.
2) STC Rating: 55.
3) Finish: As selected by Architect to match mullion finish, unless indicated otherwise.

2.11 FASTENERS

A. Limitations: Nails and staples are not permitted.

B. Fasteners for Attaching Metal Framing to Concrete Structure:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.

a. Cast-in-place anchor, designed for attachment to concrete.
b. Post-installed chemical anchor.
c. Post-installed expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, ANSI A 10.3; low velocity, powder-actuated fasteners; drive pins and clip angles fabricated from

corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

3. Manufacturers:

   a. Construction Materials, Inc.
   b. Heckman Building Products, Inc.
   c. Hilti Corp.
   d. ITW Ramset/Red Head.
   e. Powers Fasteners.
   f. Simpson Strong Tie Anchor Systems.

4. For post-tensioned concrete, anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

C. Metal Framing Screws: Screw fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten metal framing and furring members securely to substrates involved; complying with recommendations of gypsum board manufacturers for applications indicated.

D. Gypsum Board Screws: Steel Drill Screws, ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. Cementitious Backer Units: Use screws of type and size recommended by panel manufacturer.
3. Product Description - Standard Applications: Bugle head, self-drilling, self-tapping, corrosion resistant steel screws with Phillips-head recess of type, size and other properties recommended by gypsum panel manufacturer.
4. Product Description - High Moisture / Humidity Applications: Bugle head, self-drilling, self-tapping, stainless steel screws with Phillips-head recess of type, size and other properties recommended by gypsum panel manufacturer; for use at high moisture areas such as Kitchens, Showers and Tub Enclosures, Saunas, Steam Rooms, and Pool Enclosures.

E. Miscellaneous Fasteners: For conditions not indicated, fasteners shall be type, finish, size, and holding power recommended by respective gypsum board manufacturer and conditions.

2.12 JOINT TREATMENT MATERIALS

A. Material Quality Standard: ASTM C 475 / C 475M.

B. Joint Tape:

1. Paper Tape: Nominal 2 in (50 mm) wide cross-fibered paper tape with finish suitable for bonding, creased in center for easy folding, and compatible with joint compound.
2. Mesh Tape: Nominal 2 in (50 mm) wide self-adhering 10-by-10 fiberglass mesh tape.

C. Joint Compound:

1. Setting-Type: Job-mixed powder for mixing with water, chemical-hardening compound; includes taping types.
2. Drying-Type: Ready-mixed or job-mixed powder for mixing with water, air-drying, vinyl based compounds; includes taping, topping, and all-purpose types.

2.13 INTERIOR SURFACING COMPOUNDS

A. Level 5 Primer and Surfacer: Latex based compound containing polyvinyl acetate (PVA) polymer that can be spray or roller applied to change a Level 4 finish to a Level 5 finish.

1. Manufacturers and Products:

a. CertainTeed Corporation; ProRoc Level V Wall and Ceiling Primer/Surfacer.
b. United States Gypsum Company (USG); Sheetrock Brand Tuff-Hide Primer-Surfacer.

B. Concrete Surfacing Compound: Vinyl-based, factory-formulated product applied in two or more coats as necessary for filling and smoothing to provide monolithic concrete surfaces to match Gypsum Board Level 4 finish.

1. Basis of Design: United States Gypsum Company (USG); Cover Coat Brand Compound.

2.14 RELATED MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced quality standards and recommendations of gypsum board manufacturer.

B. Firestopping Products at Penetrations: As specified in Division 07 Section "Penetration Firestopping".

C. Fiberglass Sound Attenuation Blankets:

1. Material Quality Standard: ASTM C 665, Type I.
2. Description: Unfaced blankets produced by bonding inorganic glass fibers with a thermosetting binder; free of formaldehyde.
3. Surface Burning Characteristics: According to ASTM E 84/NFPA 255/UL 723:

a. Flame Spread: Class A - no greater than 25.
b. Smoke Developed: No greater than 50.

4. Thickness: Not less than 2-1/2 in (62 mm), unless otherwise indicated.
5. Manufacturers and Products:

a. CertainTeed Corporation; CertaPro AcoustaTherm Batts.
b. Johns Manville Building Insulation Div.; Sound Control Batts, Formaldehyde Free.
c. Knauf Fiber Glass; QuietTherm.
d. Owens Corning; Sound Attenuation Batts.

D. Mineral Wool Sound Attenuation Blankets:

1. Material Quality Standard: ASTM C 665, Type I.
2. Description: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of rock or slag with thermosetting resins; free of formaldehyde.
3. Surface Burning Characteristics: According to ASTM E 84/NFPA 255/UL 723:

a. Flame Spread: Class A - no greater than 25.
b. Smoke Developed: No greater than 50.

4. Thickness: Not less than 3 in (75 mm), unless otherwise indicated.
5. Density: Not less than nominal 2.5 pounds per cubic foot.
6. Manufacturers:

a. Fibrex Insulations, Inc.
b. Rock Wool Manufacturing Co.
c. Roxul.

d. Thermafiber LLC.

E. Acoustical Sealant:

1. Description: Manufacturer's standard nonsag, paintable, nonstaining sealant complying with ASTM C 834 or ASTM C 920. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90 or other acceptable test method.

a. Preconstruction Compatibility Testing: Test sealant for compatibility with copper substrates. Testing will not be required if data submitted on previous testing of current sealant products matches those submitted.
b. Do not use acrylic, neoprene, and nitrile based sealants that are not recommended for use with copper substrates.

F. Fire-Resistance Rated and Acoustical Putty Pads:

1. Product Quality Standard: UL 263 (ASTM E 119).
2. Description: Fire-rated, non-hardening, moldable, intumescent compound formed into sheets designed to seal penetrations, construction gaps, and around electrical boxes against spread of fire, smoke, and toxic gases.
3. Manufacturers and Products:

a. Grace Construction Products; Flamesafe FSP 1077 Putty Pads.
b. Hilti; CP 617 Intumescent Acoustic Putty Pads.
c. Hilti; CFS-P PA.
d. Specified Technologies, Inc; Series SSP Putty Pads.
e. Tremco; TREMstop Electrical Box Insert.
f. 3M; Fire Barrier Moldable Putty+Pads.

G. One-Piece Barrier Box:

1. Description: Rigid reinforced polyethylene box designed to fit around electrical boxes to prevent leaks of air and vapor.
2. Basis of Design: Lessco Air-Vapor Barrier Box.

H. Fire Resistive Sealants: Intumescent elastomeric sealant as specified in Division 07 Section "Fire-Resistive Joint Firestopping".

I. Sealants: Sealant as specified in Division 07 Section "Joint Sealants".

J. Isolation Strips: Adhesive-backed, closed cell neoprene or vinyl foam strips that allow fastener penetration with foam displacement, size as indicated, compressed 50 percent.

K. Drywall Penetration Barrier Mesh: Barrier mesh, 0.048-inch (16 gauge) steel, 3/4-inch flattened diamond expanded-metal panels as a penetration barrier behind gypsum wallboard walls and/or ceilings, where indicated on Drawings.

1. Barrier-Mesh Clips: Barrier mesh shall be attached to framing members using barrier-mesh clips and appropriate threaded fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner

complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective Manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.
4. ASTM C754 Standard Specification for installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
5. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board.
6. Gypsum Association GA 216.
7. United States Gypsum Company (USG); Gypsum Construction Handbook when no other installation quality standard applies to condition.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Suspended Gypsum Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hanger wires at spacing required to support ceilings and that hangers will develop their full strength.

C. Coordination with Sprayed Fire-Resistance Materials:

1. Pre-Application Coordination: Before sprayed fire-resistance materials are applied, attach Z shaped clips and offset mounting plates to structural steel members with powder actuated fasteners, leaving portion of flange exposed outside of sprayed fire-resistive materials to attach head of wall track for gypsum board assembly.
2. Post-Application Coordination: After sprayed fire-resistive materials are applied, remove materials only to extent necessary for installation of gypsum board assemblies, attach Z shaped clips and offset mounting plates to structural steel members with powder actuated fasteners, leaving portion of flange exposed outside of sprayed fire-resistive materials to attach head of wall track for gypsum board assembly, and patch with fire-resistive material specified in Division 07 Section "Cementitious Fireproofing" that is required to obtain fire-resistance rating indicated.

3.4 INSTALLATION OF GYPSUM BOARD ASSEMBLIES

A. Resistance Rated Partitions: Construct fire resistance rated, smoke resistance rated, and sound resistance rated partitions according to respective assembly test reports. Ensure every material used within an assembly shall comply with manufacturers listed and product qualities indicated in respective assembly test report.

B. Penetrations and Openings: Construct within gypsum board assemblies work as required to properly form penetration or opening to receive firestopping materials specified in following Sections:

1. Division 07 Section "Penetration Firestopping".
2. Division 07 Section "Fire-Resistive Joint Firestopping".

C. Control Joints: Install control joints at locations indicated on Drawings, in specific locations approved by Architect for visual effect and according to the following:

1. Spaced not more than 24 to 30 feet in either direction for uninterrupted straight planes of ceilings and walls.
2. Where different substrates occur at ceilings and walls.
3. Where control joints occur in substrates at ceilings and walls.
4. Where L, U, or T shaped ceiling configurations are joined.
5. At less-than-ceiling-height cased opening frames and gypsum board openings over 60 inches in width; extend control joints from both corners at top of frame or opening up to ceiling.
6. Where less-than-ceiling-height door frames occur on walls more than 30 feet in length; extend control joints from top of frame up to ceiling at corner of hinge side of door
7. Where less-than-ceiling-height borrowed lites occur on walls more than 30 feet in length; extend control joints from top of frame up to ceiling and from bottom of frame to floor at both corners.

D. Isolation from Building Structure: Isolate gypsum board assemblies from building structure to prevent transfer of loading imposed by structural movement.

1. Provide isolation joints as indicated or required by installation quality standards.
2. Isolate ceiling assemblies abutting or penetrated by building structure.
3. Isolate partition framing and wall furring abutting or penetrated by building structure, except at floor.

E. Building Expansion Joints: Avoid bridging building expansion joints with metal framing or furring members; frame both sides of joints independently with framing or furring members, coordinating with building expansion joint products specified in Division 07 Section "Expansion Control".

F. Fire-Resistance Rated and Acoustical Putty Pads: Hand apply pads to surfaces indicated, packing tightly into gaps and openings, in such a manner that pad will remain secured to surface; pinch pleat excess material together to close gaps.

G. One-Piece Barrier Box: Install in accordance with manufacturer's recommendations as indicated on the Drawings.

H. Supplemental Accessories: Install supplementary framing, blocking, reinforcing, and bracing in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, hand rails, furnishings, or similar construction. Comply with details indicated and recommendations of installation quality standards or manufacturer.

3.5 INSTALLING SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

A. Installation Quality Standard: In addition to standards listed elsewhere, perform suspended ceiling work according to following, unless otherwise specified in this Section:

1. ASTM C 636 / C 636M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
2. ASCE/SEI 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
3. ASTM E 580 / E 580M, Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

B. Pattern: Lay out spaces and arrange suspension system in a regular pattern, parallel or perpendicular to surrounding walls.

C. Hangers for Ceiling System: Suspend hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with mechanical and electrical equipment, insulation or other objects within ceiling plenum that are not part of supporting structural frame or ceiling suspension system. Within limitations allowed by installation quality standards, splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers required to support suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by installation quality standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure the appropriate hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Install metal framing components for suspended ceilings so that members are level to within 1/8 in in 12 ft (3 mm in 3.6 m) as measured both lengthwise on each member and transversely between parallel members.
6. Attach hangers to structural members.
7. Do not connect or suspend any ceiling components from ducts, pipes or conduit.

D. Perimeters: Using gypsum board screws through gypsum board into metal studs, attach perimeter wall angle where suspended grid system meets vertical surfaces unless otherwise indicated; cut main beams and cross furring members to fit into wall angle.

E. Main Beams:

1. Suspend main beams spaced 48 in (1200 mm) on center from structure with wire hangers spaced not greater than 48 in (1200 mm) on center.
2. Install main beams level within 1/8 in in 12 ft (3 mm in 3.6 m) with hanger wire taut and tightly wrapped to prevent vertical movement or rotation.
3. Do not make local kinks or bends in hanger wires as a means of leveling.

F. Cross Furring Members:

1. Install cross furring members at right angles to main beams, spaced as required and join to main beams with positive interlock.
2. Install cross furring members to within 1/32 in (0.8 mm) of their required location and within 0.015 in (0.38 mm) of same horizontal plane as main beam, and never below continuous member.
3. Install additional cross furring members at right angles to beams and cross furring members to support ends of recessed light fixtures, diffusers or grilles.

G. Seismic Conditions: Install bracing wires, compression struts, and other components as required by installation quality standard.

3.6 INSTALLING SUSPENDED CHANNEL FRAMED SYSTEM FOR INTERIOR CEILINGS

A. Installation Spacings: Install framing components at spacings indicated but not less than that required by referenced metal framing installation quality standard.

1. Wire Hangers: 4 ft (1200 mm) on centers.
2. Carrying Channels (Main Runners): 1-1/2 in (38 mm), 4 ft (1200 mm) on centers.
3. Metal Furring Channels (Furring Members): 16 in (400 mm) on centers.

B. Seismic Conditions: Install bracing wires, compression struts, and other components as required by installation quality standard.

3.7 INSTALLING METAL FRAMING COMPONENTS

A. Priority: Assemble various assemblies giving priority to partitions with higher rating; extend partition with higher rating intact through partition with lower rating.

B. Joinery and Connections: Install various metal framing components according to details indicated; for situations and conditions not indicated, comply with installation quality standards and with respective manufacturer's recommendations.

C. General Requirements: Construct partition framing of studs, tracks, and headers using screws of number and spacing required.

1. Install studs of uncoated base metal thickness as determined by Metal Framing Schedule at end of this Section.
2. Extend partition framing full height to underside of structure above, except where partitions are indicated to terminate at, or immediately above, suspended ceilings.
3. Continue framing over door frames and openings to provide support for gypsum board.
4. Space studs as indicated on Metal Framing Schedule at end of this section.
5. Cut studs 1 in (25 mm) short of full height to provide deflection relief at head of wall conditions.
6. Install studs so that flanges point in same direction.
7. Attach with screws through each stud flange and track (runner) flange, except top deflection track assemblies.
8. For fire resistance rated, smoke resistance rated, and sound resistance rated assemblies that are required to extend to underside of structure above to obtain ratings, install framing around structural and other members extending below floor slabs or roof decks, as needed to support gypsum board closures and make partitions continuous from floor to underside of structure above.
9. Do not lap studs.
10. At intersections and corners, locate studs no more than 2 in (50 mm) from partition intersections and corners and secure with screws through both flanges of studs and tracks.

D. Metal Track (Runner) Requirements:

1. Floors: Install tracks (runners) using appropriate fasteners spaced not more than 16 in (400 mm) on centers.
2. Head of Wall: Install deep leg deflection tracks using appropriate fasteners to laterally support assembly, and to avoid axial loading of assembly by deflection from building structure above.
3. Head of Wall: Where indicated, install proprietary deflection and firestop track (runner) using appropriate fasteners for the substrate and installation conditions.

E. Support for Wall Mounted Accessories or Equipment: Install back-up plate or track (runner) turned on its side, using screws as indicated or as required, to studs to properly transfer accessory or equipment load to metal framing.

F. Openings: Frame single door, double door, above ceiling openings, and below ceiling openings using studs, tracks (runners), clip angles, and headers.

1. Install 2 studs on each side of each opening in configuration indicated, including strap plates; extend from floor to underside of structure above; do not cut these studs under any circumstances. Include sound attenuation blankets within cavity when partition is scheduled to have a sound resistance rating.
2. Construct header of appropriate configuration for type of opening to be spanned and secure with clip angles; include sound attenuation blankets within cavity when partition is scheduled to have a sound resistance rating.
3. Install short intermediate studs 16 in (400 mm) on center between top track and header.
4. At partitions indicated to terminate immediately above ceiling, install diagonal bracing at not less than spacing as indicated.

G. Supplementary Framing: Install around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by metal framing.

H. Penetrations: Maintain fire-resistance rating of assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

I. Chase Partitions:

1. Position double row of studs vertically in tracks (runners), opposite each other in pairs with flanges pointing in same direction.
2. Attach with screws through each stud flange and track (runner) flange.
3. Cross brace between rows of studs with one of following at 48 in (1200 mm) on center maximum vertically, attached to stud webs with screws:

   a. Coated glass-mat gypsum board, 12 in (300 mm) high by chase width.
   b. Metal studs turned on side, webs back-to-back.

J. Furred Walls:

1. Erect furring channels vertically, spaced 16 in (400 mm) on centers maximum, unless otherwise indicated.
2. Attach with appropriate fasteners, staggered on flanges.
3. Splice ends by nesting channels 8 in (200 mm) and securely anchoring to surface.
4. Miter 24 in (600 mm) long horizontal furring channels at corners and space 24 in (600 mm) on centers vertically.
5. Locate furring channels around perimeter of openings and secure to surfaces.

K. Control Joints:

1. Construct metal framing as indicated by installation quality standard to allow gypsum board control joints to function as intended.
2. For control joints located in fire resistance rated walls and partitions, construct of metal studs and mineral wool, full height of partition, according to assembly fire test reports.

L. Metal Framing Spanning Multiple Floors: Construct metal framing as required using longest length metal studs possible and attach to building structure with floor bypass clips.

M. Curved Partitions:

1. Metal Track (Runner) shall comply with one of following:

   a. Field Fabricated From Straight Components:

1) Cut top and bottom runners (tracks) through leg and web at 2 in (50 mm) intervals for arc length. In cutting lengths of runners allow for uncut straight lengths of not less than 12 in (300 mm) at ends of arcs.
2) Bend runners to uniform curve of radius indicated and locate straight lengths so they are tangent to arcs.
3) Support outside (cut) leg of runners by clinching a 1 in (25 mm) high by runner thickness sheet metal strip to inside of cut legs using metal lock fasteners.

b. Field crimped using a crimping tool.
c. Manufactured flexible products.

2. For full height partitions, attach runners to structural elements at floor and ceiling with appropriate fasteners located 2 in (50 mm) from ends and spaced 12 in (300 mm) on centers.
3. For ceiling height partitions, attach runners to suspended ceilings with toggle bolts or hollow wall anchors located 2 in (50 mm) from ends and spaced 8 in (200 mm) on centers in between where attached to suspended ceilings.
4. Position studs vertically with open sides facing in same direction and engaging floor and ceiling runners.
5. Begin and end each arc with a stud and space intermediate studs equally along arcs at stud spacing recommended by gypsum board manufacturer for radii indicated.
6. Attach studs to runners with 3/8 in (10 mm) long pan head framing screws. On straight lengths at ends of arcs, place studs 6 in (150 mm) on centers with last stud left free standing.

N. Security Mesh: Where indicated, attach to metal studs before installation of gypsum board.

O. Installation Tolerances: Install each metal stud metal framing and furring member so that fastening surfaces do not vary more than 1/8 in (3 mm) from plane formed by faces of framing members.

3.8 INSTALLING GYPSUM BOARD PRODUCTS

A. General Requirements:

1. Install type of gypsum board at location indicated by gypsum board schedule at end of this Section.
2. Do not install damaged gypsum boards.
3. Install gypsum boards with finishable face side out.
4. Butt gypsum boards together for a light contact at edges and ends with not more than 1/16 in (1.5 mm) of open space between panels.
5. Do not force gypsum boards into place.
6. Do not place tapered edges against cut edges or ends.
7. Locate panel joints so that no joint will align with the edge of an opening unless control joints are installed at these locations.

B. Isolation from Building Structure:

1. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments or surfaces where movement is anticipated. Provide 1/4 in to 1/2 in (6 mm in 12 mm) wide spaces at these locations or as indicated below:

a. At top of wall or where partitions intersect open building structure members projecting below underside of floor slabs and roof decks, cut to fit profile formed by coffers, joists, beams, and other structural members; form proper annular joint to

receive firestopping at rated partitions and form 3/4 in (20 mm) joint at top of wall at non-rated partitions.

2. Trim edges with edge trim where edges of gypsum boards are exposed.
3. Seal joints between edges and abutting structural surfaces with firestopping at rated locations and acoustical sealant at non-rated locations.

C. Single-Layer Board Assemblies:

1. At typical conditions, install gypsum board vertically (long dimension parallel to metal framing), to minimize short end-to-short end joints unless otherwise indicated or required by assembly fire test reports.
2. At interior of stairwells and other high walls, install gypsum boards horizontally, unless otherwise indicated or required by assembly fire test reports. Stagger abutting end joints not less than one framing member in alternate courses of gypsum boards.

D. Multi-Layer Board Assemblies: Apply base layers and face layers vertically (long dimension parallel to metal framing) with joints of base layers located over stud or furring member and face layer joints offset at least one stud space from base layer joints, unless otherwise indicated or required by assembly fire test reports. Stagger joints on opposite sides of partitions.

E. Ceiling Applications:

1. Apply gypsum board at right angles to main beams of suspension framing to minimize number of abutting end joints and avoid abutting end joints in central area of each ceiling.
2. Stagger abutting end joints of adjacent panels not less than one framing member.
3. Locate both edge or end joints of gypsum boards over intermediate supports or gypsum board back-blocking where metal framing is not present.

F. Typical Wall Applications:

1. Attach gypsum boards to metal studs so that leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.
2. Stagger vertical joints on opposite sides of partitions.
3. Do not make joints other than control joints at corners of framed openings.
4. Attach gypsum boards to framing provided at doors, openings and cutouts. Install gypsum boards over door heads and extend to not less than one stud space - 16 in (400 mm) at each side of door or opening.
5. Cover both faces of metal framing with gypsum boards as indicated, except in chase walls that are braced internally.
6. Cut and fit gypsum boards around ducts, pipes, conduits, and other penetrations to form proper annular joint to receive firestopping at rated partitions.

    a. At non-rated partitions, annular space around ducts, pipes, conduit or other penetrations to be properly sized to receive sealant; 3/4 in (20 mm) maximum.
    b. "Blow–out" patches are not allowed.

7. Support both edge and end joints of gypsum boards over metal framing.

G. Curved Wall Assemblies:

1. Install 2 layers of flexible gypsum board horizontally and unbroken, to extent possible, across curved surface plus 12 in (300 mm) long straight sections at ends of curves and tangent to them.
2. On convex sides of partitions, begin installation at one end of curved surface and fasten gypsum boards to studs as they are wrapped around curve. On concave side, start fastening gypsum boards to stud at center of curve and work outward to panel ends.

3. Fasten base layer to studs with screws spaced 16 in (400 mm) on centers maximum. Center second layer over joints in base layer, and fasten to studs with screws spaced 12 in (300 mm) on centers maximum.

H. Screw Attachments:

1. Attach gypsum board to metal framing with screw fasteners of type appropriate for gypsum board materials and installation conditions:

   a. Length shall be as required by condition and penetrating metal framing not less than 3/8 in (10 mm).
   b. Spacing shall be as recommended by installation quality standard, gypsum board manufacturer, or respective assembly test report.
   c. Use properly adjusted, positive-clutch electric power tool equipped with adjustable screw-depth head and a Phillips bit. Nails and staples are not permitted.

2. Drive screws to slightly dimple surface without breaking face paper, fracturing core, or stripping metal framing member around screw shank.
3. Space screws for non-fire resistance rated partitions and ceilings as recommended by installation quality standards.
4. Space screws for fire resistance rated partitions as required by assembly fire test reports.
5. Start field screwing near center and work towards edges.
6. Space screws not less than 3/8 in (10 mm) from gypsum boards edges.
7. Do not attach gypsum boards to top runner where wall or partition extends to building structure unless required by fire test reports.

I. Control Joints: Form control joints and expansion joints at locations indicated with required space between edges of adjoining gypsum boards.

J. Sound Attenuation Blankets: Install blankets within stud cavities set so that they are held in place by friction with metal studs; ensure blankets are secure within cavity and will not become displaced when second gypsum board side is closed.

K. Elevator Shaft Cants: Where gypsum board shaftwall assemblies cannot be positioned within 4 in (100 mm) of shaft face of structural beams, floor edges, and similar projections into shaft, install 5/8 in (15 mm) thick gypsum board cants covering tops of projections.

1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 in (600 mm) on centers with screws fastened to shaftwall framing.
2. Where steel framing is required to support gypsum board cants, install framing at 24 in (600 mm) on centers and extend studs from projection to shaftwall framing.

L. Sealant:

1. Comply with ASTM C 919 and manufacturers written recommendations for closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
2. Seal wall assemblies at perimeters, behind control joints, and at openings and penetrations with a continuous bead of sealant material according to following:

   a. Fire Resistance Sealant: Joints within fire resistance rated assemblies.
   b. Water Resistance Sealant: Joints within non-fire resistance rated assemblies exposed to possible water infiltration.
   c. Acoustical Sealant: All other joints.

3.9 INSTALLING TRIM ACCESSORIES

A. General: Fasten trim accessories continuously according to accessory manufacturer's instructions using gypsum board screws; installation by clinch-on tool and staples not permitted.

B. Interior Trim Accessories: Install in the following locations:

1. Corner Beads: Install trim at external corners; use screws at each flange at 9 in (225 mm) on centers, opposite each other.
2. Edge Trim: Install trim where gypsum boards abut dissimilar material, and where edge of gypsum boards would otherwise be exposed; use screws at flange at 9 in (225 mm) on centers.

   a. LC-Bead (J-Bead): Install trim at exposed conditions where back flange can be attached to framing or supporting substrate before gypsum board installation.
   b. L-Bead: Install trim at exposed conditions where trim can only be installed after gypsum board installation.
   c. J-Stop: Install trim at concealed conditions where trim can only be installed after gypsum board installation.

3. Control Joints: Install trim at appropriate locations, ensuring gypsum board is not continuous over joint; use screws at each flange at 6 in (150 mm) on centers.

   a. Control joints to extend 4 in (100 mm) above finished ceiling at non-rated conditions and extend to structure at rated wall conditions.

C. Accent Trim Accessories: Install at locations indicated, mitering corners and intersections to form tight, flush and uniform joints; use screws at each flange at 9 in (225 mm) on centers.

D. Trim Accessories at Exterior Windows: Install at locations indicated, mitering corners and intersections to form tight, flush and uniform joints; use screws at each flange at 9 in (225 mm) on centers or as recommended by manufacturer for manufactured products.

3.10 FINISHING GYPSUM BOARD PRODUCTS

A. General: Treat board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare surfaces for decoration.

B. Joint Tape: Finish joints according to the following and as recommended by manufacturer:

1. Typical Paper-Faced Gypsum Board Products: Paper tape.
2. Moisture-Resistant Gypsum Board Products:

   a. Moisture-Resistant Paper-Faced Gypsum Board: Paper tape.
   b. Moisture-Resistant Paperless Glass-Mat Gypsum Board: Paper or mesh tape.
   c. Moisture-Resistant Coated Glass-Mat Gypsum Board - Tile Backer: Mesh tape.

3. Cementitious Backer Units: Mesh tape.

C. Finishing: Finish boards and units to achieve specified level of finish as indicated in schedule at end of Section:

1. Typical Paper-Faced Gypsum Board: Either or combination of the following as recommended by manufacturer:

   a. Setting-type joint compounds.
   b. Drying-type joint compounds.

2. Moisture-Resistant Paper-Faced Gypsum Board: Setting-type joint compounds.
3. Cementitious Backer Unit: Setting-type joint compounds.

3.11 INTERIOR SURFACING COMPOUNDS

A. Skim Coat Finishing with Joint Compound - Gypsum Board:

1. Apply setting-type joint compound or Level 5 Primer and Surfacer over entire surface in thickness recommended by manufacturer.

B. Skim Coat Finishing with Concrete Surfacing Compound - Concrete:

1. Prepare concrete surfaces for applied finishes.

a. Grind ridges, fins, and high areas.
b. Remove form oil, efflorescence and greasy deposits.
c. Fill offsets, voids, bugholes, rock pockets level with surrounding surfaces with concrete surfacing compound.
d. Apply as many coats of concrete surfacing compound as necessary to eliminate cracks.
e. Verify that resulting concrete surface is uniformly smooth and free of irregularities.

2. Apply Concrete Surfacing Compound over entire surface in thickness recommended by manufacturer.

3.12 ADJUSTMENTS

A. Damaged Materials: Stored or installed gypsum board materials shall be classified as damaged, defective, and nonconforming Work if they have been exposed to wetness or dampness at any time prior to Substantial Completion or if they exhibit evidence of active or dormant mold or mildew. Damaged materials and assemblies shall be replaced with new and dry materials and assemblies.

3.13 PROTECTION

A. Procedures: Protect products and systems from damage during installation and remainder of construction period according to manufacturer's instructions.

3.14 METAL FRAMING SCHEDULE

A. Metal Stud Framing Schedule:

1. Stud Depth: As indicated on Drawings.
2. Spacing: Maximum 16 in (400 mm) on centers, unless otherwise indicated, or as required to comply with respective assembly test report.
3. Minimum Performance Requirements: Lateral pressure loads (lb/sq ft) are allowable design values and shall not be reduced further by load combinations. Minimum performance requirements unless otherwise indicated:

a. Typical Partitions: L/240 at 5 lb/sq ft (239 Pa) lateral load.
b. Elevator Shaft Partitions: L/240 at 7.5 lb/sq ft (359 Pa) lateral load.
c. Partitions with Tile Facing: L/360 at 7.5 lb/sq ft (359 Pa) lateral load.
d. Partitions with Interior Stone Facing Concentrated Loads: Provide delegated engineering to comply with L/720 at 10 lb/sq ft (479 Pa) lateral load.
e. Partitions supporting Lead Lined Doors and Frames: Provide delegated engineering to comply with L/480 at 10 lb/sq ft (479 Pa) lateral load.
f. Partitions supporting all other Concentrated Loads: Provide delegated engineering to comply with L/360 at 10 lb/sq ft (479 Pa) lateral load

4. Minimum Uncoated Base Steel Thickness:

a. Typical Gypsum Board Assemblies: As determined by manufacturer's limiting height engineering data unless otherwise indicated.

1) 20 Gauge Drywall Studs: 0.0296 inch (0.75 mm) minimum base steel thickness.

a) Typical partitions unless otherwise indicated.

2) 20 Gauge Equivalent Studs: Allowed only when included as part of an approved tested assembly.

3) 20 Gauge Structural Studs: 0.0329 inch (0.84 mm) minimum base steel thickness.

a) Partitions supporting ceramic or stone tile.

b. 16 Gage Studs:

a) Typical at partitions supporting stone facing unless otherwise indicated.

c. Gypsum Board Assemblies required to Support Concentrated Loads: As required by delegated engineering professional but not less than minimum uncoated base metal thickness indicated above.

d. Gypsum Board Assemblies required to Withstand Seismic Loads: As required by delegated engineering professional but not less than minimum uncoated base metal thickness indicated above.

3.15 GYPSUM BOARD SCHEDULE

A. Gypsum Board Schedule, General: Install the designated gypsum board product based on exposure classification to water and / or moisture and applied finish system as follows, unless otherwise indicated or scheduled on the Drawings.

B. No Exposure: Surfaces not normally exposed to water and / or moisture sources, including but not limited to the following locations:

1. Typical walls and ceilings.

a. Paint and Wall Coverings Only: Typical paper-faced gypsum board.

b. Tile: Moisture-resistant coated-glass-mat gypsum board.

2. Horizontal fire-rated assemblies and ceilings:

a. Paint Only: Paper-faced Type C gypsum board.

3. Walls in acoustical barriers as indicated in the Drawings.

a. Paint and Wall Coverings Only: Paper-faced acoustically enhanced gypsum board.

4. Curved walls:

a. Paint and Wall Coverings Only: Paper-faced flexible gypsum board; installed in two layers.

5. Shaft-Side Face of Shaft-Liner Assemblies:

a. No Finish Required: Moisture-resistant paperless glass mat shaft-liner gypsum board.

b. No Finish Required: Moisture-resistant paper-faced shaft-liner gypsum board.

C. Incidental Exposure: Surfaces immediately adjacent to water and / or moisture sources, including but not limited to the following locations:

1. Walls and ceilings in mechanical equipment rooms and janitor closets.

2. Walls within 24 inches of centerline of drinking fountains, isolated wall-hung lavatories, and countertop sinks and other similar water sources.
3. Interior face of exterior walls.
4. Acceptable gypsum board products for the above listed conditions:
   a. Paint and Wall Coverings: Moisture-resistant paper-faced or moisture-resistant paperless glass-mat gypsum board.
   b. Tile: Moisture-resistant coated-glass-mat gypsum board.
5. Top of walls above ceilings adjacent to mechanical equipment in corridors.
   a. Moisture-resistant paperless glass-mat gypsum board.

D. Direct Exposure: Surfaces normally soaked, saturated, or regularly and frequently exposed to water and / or moisture, including but not limited to the following locations:
1. Walls and ceilings in commercial kitchens, toilet rooms and bathrooms including bathtubs and showers:
   a. Paint and Wall Coverings: Moisture-resistant paper-faced or moisture-resistant paperless glass-mat gypsum board.
   b. Tile: Moisture-resistant coated-glass-mat gypsum board.
2. Walls and ceilings in saunas, steam rooms, gang showers, and pool enclosures:
   a. Tile Only: Cementitious backer units.

E. Any Exposure:
1. Moisture-Resistant, Abuse-Resistant Gypsum Board Products: Where indicated on drawings.
   a. Paint and Wall Coverings: Paper-faced or paperless products.
   b. Tile: Paperless products.
2. Moisture-Resistant, Impact-Resistant Gypsum Board Products for Enclosing High-Rise Elevator Shafts and Stairwells: Where indicated on drawings.
   a. Paint and Wall Coverings: Paper-faced or paperless products.
   b. Tile: Paperless products.
3. Moisture-Resistant, Impact-Resistant Gypsum Board Products: Where indicated on drawings.
   a. Paint and Wall Coverings: Paper-faced or paperless products.
   b. Tile: Paperless products.

3.16 GYPSUM BOARD FINISHING SCHEDULE

A. Gypsum Board Finishing Schedule, General: Finish panels to Levels of Finish indicated below. Apply joint tape over panel joints, except those with trim having flanges not intended for tape. Sand between coats and after last coat to produce a surface free of defects and ready for applied finish system.
1. Levels of Finish: According to ASTM C 840.

B. Preparation: Apply joint compound at open joints, panel edges, and damaged surface areas.

C. Level 1: At following locations, embed tape at joints in joint compound unless a higher level of finish is required for fire resistance rated assemblies. Trim accessories to be installed but not embedded in joint compound unless required for fire rating:
1. Ceiling plenum areas above ceilings.

2. Concealed areas.
3. Substrate for interior stone facing.
4. Substrate for interior woodwork.
5. Unfinished areas designated for future expansion.
6. Not used.

D. Level 2: At following locations, embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges:

1. Substrate for tiling.
2. Not used.

E. Level 3: At following locations, embed tape and apply separate first and second coats of joint compound to tape, fasteners, and trim flanges:

1. Mechanical, electrical, data and elevator equipment rooms.
2. Stair towers.
3. Not used.

F. Level 4: At following locations, embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges:

1. Areas to receive paint.
2. Areas to receive wall coverings.
3. Areas to receive veneer plastering.
4. Not used.

G. Level 5: At following locations, embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound or Level 5 Primer and Surfacer over entire surface:

1. Areas to receive whiteboard paint or dry erase board coatings.
2. Curved ceilings and partitions.
3. Front of House or Public areas.

   a. Areas to receive paint.
   b. Areas to receive wall coverings.
   c. Areas to receive veneer plastering.

4. Other areas as indicated on the Drawings.
5. Not used.

3.17 FIELD QUALITY CONTROL

A. Owner Acoustical Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Testing and inspections may include the following.

1. Airborne-Sound Testing, Horizontal and Vertical: Perform testing of installed assemblies for noise isolation in accordance with ASTM E 336 Standard Test Method from Measurement of Airborne Sound Attenuation between Rooms in Buildings, ASTC (Apparent Sound Transmission Class) determined by ASTM E413 Classification for Rating Sound Insulation.

   a. Extent of Testing: Testing agency shall randomly select assemblies for testing.

2. Structure-Borne Sound Testing, Vertical: Perform testing of installed assemblies for noise isolation in accordance with ASTM E 1007 Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission through Floor-Ceiling Assemblies and Associated Support Structures, AIIC (Apparent Impact Isolation Class)

determined by ASTM E989 Standard Classification for Determination of Single-Number Metrics for Impact Noise.

a. Extent of Testing: Testing agency shall randomly select assemblies for testing.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 093000
TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Modular tiles, membrane underlayments, setting materials, grouting materials, accessories, and supplementary items necessary for installation.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 and ANSI A137.3 apply to Work of this Section unless otherwise specified.

B. Module Size: Actual tile size plus joint width indicated.

C. Face Size: Actual tile size, excluding spacer lugs.

D. Ceramic (Mosaic) Tile: Tile formed by either the dust-pressed or plastic method, usually 1/4 in to 3/8 in (6 mm to 10 mm) thick, and having a facial area of less than 6 sq in (3900 mm²). Ceramic mosaic tile may be of either porcelain or natural clay composition and they may be either plain or with an abrasive mixture throughout.

E. LHT: Large and Heavy Tile. Tiles are typically larger than 12 in by 12 in (300 mm by 300 mm) or with at least one side greater than 15 in (375 mm) or weigh 5 psf (239 Pa) or heavier and have an ungauged thickness.

F. Paver Tile: Glazed or unglazed porcelain or natural clay tile formed by dust-pressed method having a facial area of 6 sq in (3900 mm²) or more.

G. Porcelain Tile: A ceramic tile or paver tile that is generally made by the dust-pressed method of a composition resulting in a tile that is dense, impervious, fine grained, and smooth with sharply formed face and with a porosity of less than 0.5.

H. Gauged Porcelain Tile Panels/Slabs: A ceramic tile or panel size greater than or equal to 11 sq ft (1 sq m).

I. Quarry Tile: Glazed or unglazed tile, made by extrusion process from natural clay or shale usually having a facial area of 6 sq in (3900 mm²) or more.

J. Wall Tile: A glazed tile with a body that is suitable for interior use and which is usually non-vitreous and is not required nor expected to withstand excessive impact or be subject to freezing and thawing conditions.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturers technical literature for each product and system indicated.

1. Include manufacturers specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings:

1. Include plans of rooms and elevations of walls showing tile and patterns; include sections showing underlayments, setting materials, and grouting materials.
2. Include details showing widths and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification Purposes: Submit samples for each item listed below of size and construction indicated. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Tile: Each type and composition of tile and for each color and finish required, at least 12 in (300 mm) square, mounted on rigid panel, and with grouted joints using product complying with specified requirements and in color approved for completed work.
2. Tile Trim and Accessories: Full-size units of each type and for each color required.
3. Stone Thresholds: 6 in (150 mm) lengths of specified profile.
4. Simulated Stone (Solid Surfacing) Thresholds: 6 in (150 mm) lengths of specified profile.
5. Metal Edge Strips: 6 in (150 mm) lengths of specified profile.

1.4 INFORMATIONAL SUBMITTALS

A. List of Materials for Layered Mock-Up for Construction Quality Purposes:

1. Product, material, and equipment names, model numbers, lot numbers, batch numbers, source of supply, and other information required to identify items used.
2. Receipt of list does not constitute acceptance of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.

B. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

C. Warranty:

1. Provide manufacturers written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Include in operation and maintenance manual required by Division 01 Section Closeout Requirements. Submit manufacturers instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.
b. Build mock-ups in a layered fashion omitting tile in particular areas to reveal underlayment membranes and setting bed installation including but not limited to the following:

1) Tiled floor conditions at thin-set mortar setting beds.

2) Tiled floor conditions at LHT mortar setting beds.
3) Tiled floor conditions at thick-set mortar setting beds.
4) Movement joints at tiled floor conditions.
5) Tiled shower stall including three walls, floor, curb, and threshold.
6) Tiled wall conditions, including one interior corner.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Install tile only when construction in room is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer’s written instructions.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

A. Manufacturer Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period - Shower Tiling System: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 25 years from date of Substantial Completion.

B. Installer Warranty: Furnish installer’s written workmanship warranty signed by an authorized representative using installer’s standard form agreeing to provide labor required to repair or

replace work which exhibits workmanship defects. Defects is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Tiling: Obtain tile of each type and color or finish from single source or producer.

a. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
b. Obtain setting and grouting materials from single manufacturer.

2. Shower Tiling System: Obtain system products from single manufacturer and each aggregate from single source or producer.

a. Obtain setting and grouting materials from single manufacturer.
b. Obtain waterproof membrane, crack isolation, and other required membranes from manufacturer of setting and grouting materials.
c. Obtain joint sealants from manufacturer of setting and grouting materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Slip Resistance Requirements for Floor Tile: Products and installation shall comply with ANSI A137.1, and state and local accessibility standards.

a. Slip Resistant Walkway Surfaces: Dynamic Coefficient of Friction DCOF AcuTest Method per ANSI A326.3.

1) DCOF Level Walkways: Minimum 0.42.
2) DCOF Inclined Walkways: Minimum DCOF as required to comply with code.

C. Floor Assembly Sound Reduction Requirements: Sound reduction membrane underlayments shall contribute to achieving following ratings in floor assemblies when tested by qualified independent testing agency acceptable to authorities having jurisdiction:

1. Sound Transmission Class (STC): As scheduled or indicated on Drawings according to ASTM E 90.
2. Impact Insulation (or Isolation) Class (IIC): As scheduled or indicated on Drawings according to ASTM E 492.

2.4 CERAMIC TILE PRODUCTS

A. Material Quality Standard: ANSI A137.1 Specifications for Ceramic Tiling and ANSI A137.3 Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs for types, compositions, and grades of tiling indicated.

1. Furnish tiling complying with Standard Grade requirements, unless otherwise indicated.

B. Ceramic Tile, General: Thin ceramic surfacing unit made from clay, porcelain, or mixture of ceramic materials, glazed or unglazed, fired above red heat to temperature sufficient to produce specific physical properties and characteristics specified.

C. Factory Blending: For tile exhibiting color variations, blend tile in factory and package so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

D. Mounting: Where factory-mounted tile is used, provide back- or edge-mounted tile assemblies as standard with manufacturer. Where tile is intended for installation in wet exposure areas, do not use factory mounted tile assemblies unless tile manufacturer states that this type of mounting is suitable for installation indicated.

E. Factory-Applied Temporary Protective Coating for Epoxy Grout Installations: Where recommended by tile and grout manufacturer, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating tile face surfaces with a continuous protective film that is easily removable without damaging tile or grout. Do not coat unexposed tile surfaces.

F. Shower and Bath Tile Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as adjoining wall tile.

1. One soap holder for each shower and tub indicated.
2. Color and Finish: As selected by Architect from manufacturer's full range.

2.5 GLASS TILE PRODUCTS

A. General: Tile having an overall non-crystalline microstructure with Silica Dioxide as the primary constituent and manufactured by one or more of three primary processes: cast, fused or low-temperature coated.

B. ANSI Glass Tile Standard: Provide glass tile that complies with ANSI A137.2 for types and other characteristics indicated.

1. Furnish tiling complying with Standard grade requirements unless otherwise indicated.

2.6 STONE TILE PRODUCTS

A. Stone Tile, General: Natural quarried stone, pre-fabricated into modular tiles having uniform and consistent dimensional tolerances; with sawn backs.

B. Material Quality Standard:

1. Granite, ASTM C 615.

2. Limestone, ASTM C 568.
3. Marble, ASTM C 503.
4. Slate, ASTM C 629.

2.7 TERRAZZO TILE PRODUCTS

A. Material Quality Standard: NTMA.

B. Terrazzo Tile, General: Precast Portland cement or epoxy resin matrix with marble chips or aggregates formed into modular tiles, with polished finish, having uniform and consistent dimensional tolerances.

2.8 WATERPROOF MEMBRANE FOR EXTERIOR APPLICATIONS

A. Material Quality Standard: ANSI A118.10.

B. Refer to Division 7 Section, Hot Fluid-Applied Rubberized Asphalt Waterproofing.

C. Faced Chlorinated-Polyethylene (CPE) Waterproofing and Crack Isolation Underlayment:

1. Description: Non-plasticized, chlorinated polyethylene sheet faced on both sides with high-strength, nonwoven polyester fabric; minimum 0.040 in (1.0 mm) nominal thickness.
2. Manufacturer and Product: The Noble Company; Noble Deck.

D. Accessories: Primer, installation adhesives/modified setting mortars, pre-fabricated corners, reinforcing, seaming cement, sealant, and other products required for application provided by underlayment manufacturer.

2.9 WATERPROOF MEMBRANE UNDERLAYMENTS FOR INTERIOR APPLICATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is acceptable to authorities having jurisdiction for use as shower pan waterproofing, as selected from one of the following available options. Include primer, installation adhesives/modified setting mortars, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products required for application provided by membrane manufacturer.

B. Unfaced Plastic Waterproof Membrane Underlayments:

1. Unfaced Chlorinated-Polyethylene (CPE):

a. Description: ASTM D 4068, non-plasticized, chlorinated polyethylene; minimum 0.040 in (1.0 mm) nominal thickness.
b. Manufacturer and Product: The Noble Company; Chloraloy.

2. Unfaced Polyvinyl Chloride (PVC):

a. Description: ASTM D 4551, flexible polyvinyl chloride sheet; minimum 0.040 in (1.0 mm) nominal thickness.
b. Manufacturer and Product: Compotite Corporation; Composeal Blue Vinyl 40.

3. Locations: Thick-set shower pan installations.

C. Faced Plastic Waterproof Membrane Underlayments:

1. Faced Chlorinated Polyethylene (CPE):

a. Description: Non-plasticized, chlorinated polyethylene faced on both sides with high-strength, non-woven polyester fabric; minimum 0.030 in (0.75 mm) nominal thickness.
b. Manufacturers and Products:

1) The Noble Company; Nobleseal TS.

2) Laticrete International Corp.; Hydro Ban Sheet Membrane.

2. Faced Polyethylene (PEVA):

a. Description: Modified polyethylene (PEVA) membrane faced on both sides with high-strength, non-woven polypropylene fabric; minimum 0.008 in (0.20 mm) nominal thickness.
b. Manufacturers and Products:

1) Schluter Systems; KERDI Waterproofing Membrane.

3. Faced Polyvinyl Chloride (PVC):

a. Description: ASTM D 4551, multiple layers of polyvinyl chloride sheet heat-fused together and to facings of bondable nonwoven polyester; minimum 0.040 in (1.0 mm) nominal thickness.
b. Manufacturer and Product: Compotite Corporation; Composeal Gold.

4. Locations: Thin-set installations at floors, walls, and ceiling; including thin-set shower pan floor installations.

D. Fluid Applied Waterproof Membrane for Wall Tiling:

1. Description: Single component self-curing liquid polymer waterproofing membrane.
2. Manufacturers and Products:

a. Laticrete International Inc.; Hydro Ban Waterproofing and Crack Isolation Membrane.
b. The Noble Company; AquaBlue Liquid Waterproofing.

2.10 CRACK ISOLATION MEMBRANE UNDERLAYMENTS

A. General: Manufacturers standard product that complies with ANSI A118.12 as selected from one of the following available options. Include primer, installation adhesives/modified setting mortars, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products required for application provided by membrane manufacturer.

B. Fluid-Applied Crack Isolation Membrane Underlayment: Not permitted or allowed within shower and bathtub areas.

1. Description: Manufacturers proprietary system consisting of liquid applied component and synthetic fabric sheet reinforcement when recommended by manufacturer.
2. Manufacturers and Products:

a. ARDEX Engineered Cements; Ardex 8 + 9 Waterproofing and Crack Isolation Membrane.
b. Custom Building Products; 9240 Waterproofing and Crack Isolation Membrane.
c. Laticrete International Inc.; Hydro Ban Waterproofing and Crack Isolation Membrane.
d. Laticrete International Inc.; Blue 92 Anti-Fracture Membrane.
e. Mapei Corp.; Mapelastic Aquadefense.
f. Sika Corp.; Merkrete Hydroguard 2000.

C. Faced Chlorinated Polyethylene (CPE) Crack Isolation Membrane Underlayment:

1. Description: Non-plasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric; minimum 0.030 in (0.75 mm) nominal thickness.
2. Manufacturer and Product: The Noble Company; NobleSeal CIS.

2.11 SOUND REDUCTION MEMBRANE UNDERLAYMENTS

A. General: Manufacturers standard product that complies with Floor Assembly Sound Reduction Performance Requirements; as selected from one of the following available options. Include primer, installation adhesives/modified setting mortars, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products required for application provided by membrane manufacturer.

B. Faced Plastic Sound Reduction Membrane Underlayments:

1. Faced Chlorinated-Polyethylene (CPE) Sound Reduction Membrane Underlayment:

a. Description: Non-plasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric; minimum 3/64 in (1.2 mm) nominal thickness.
b. Manufacturer and Product: The Noble Company; NobleSeal SIS.

1) Delta IIC, ASTM E 2179: 12.

2. Faced Polyvinyl Chloride (PVC) Sound Reduction Membrane Underlayment:

a. Description: Multiple layers of polyvinyl chloride sheet heat-fused together and to facings of bondable nonwoven polyester; minimum 0.050 in (1.25 mm) nominal thickness.
b. Manufacturer and Product: Compotite Corporation; Composeal White Gold.

1) Delta IIC: Confirm compliance with project requirements.

C. Polypropylene Sound Reduction Membrane Underlayment:

1. Description: High-density polypropylene membrane, cut-back stud structure; minimum 5/16-inch (8 mm) nominal thickness.
2. Manufacturers and Products: Schluter Systems; Ditra Heat Duo.

a. Delta IIC, ASTM E 2179: 20.

D. High-Performance, Recycled Rubber Sound Reduction Membrane Underlayment:

1. Description: High-performance, flat, resilient sound reduction underlayment made from a formulation of high quality, post-consumer-recycled, wear- and water-resistant rubber granules.
2. Manufacturer and Product:

a. ARDEX Engineered Cements; Ardex DS 70.

1) Thickness: 0.078 in (2 mm) nominal thickness.
2) Robinson Floor Test, ASTM C 627: Heavy Commercial Rating.
3) Delta IIC, ASTM E 2179: 16.

b. Laticrete International Corp.; 170 Sound and Crack Isolation Mat.

1) Thickness: 0.125 in (3 mm) nominal thickness.
2) Robinson Floor Test, ASTM C 627: Light Commercial Rating.
3) Delta IIC, ASTM E 2179 : 16.

c. Pliteq; GenieMat RST02.

1) Thickness: 0.078 in (2 mm) nominal thickness
2) Robinson Floor Test, ASTM C 627: Heavy Commercial Rating.
3) Delta IIC, ASTM E 2179 : 16.

d. Pliteq; GenieMat RST12.

1) Thickness: 0.500 in (12 mm) nominal thickness.
2) Robinson Floor Test, ASTM C 627: Light Commercial Rating.
3) Delta IIC, ASTM E 2179: 23.

E. Self-Bonding, Asphaltic Crack and Sound Reduction Membrane Underlayment:

1. Description: Self-bonding, adhesive backed fabric reinforced asphaltic mat that reduces crack and sound transmission in tile and stone floors.
2. Manufacturer and Product:

a. Custom Building Products; Crack Buster Pro Crack Prevention Mat Underlayment.

1) Thickness: 0.040 in nominal thickness.
2) Robinson Floor Test, ASTM C 627: Heavy Commercial Rating.
3) Delta IIC, ASTM E 2179: 18.

2.12 SETTING MATERIALS - MORTAR AND GROUT

A. Material Quality Standards: ANSI A118 Series as indicated.

B. Thick-Set Portland Cement Mortar:

1. Material Quality Standard: ANSI A118.1, with the following physical properties:

a. Cleavage Membrane: One of the following:

1) Any membrane underlayment product listed and designated by manufacturer to be suitable for thick-set applications.
2) Polyethylene Sheeting: ASTM D 4397, minimum 4 mils (0.10 mm) thick.

b. Portland Cement: ASTM C 150, Type I, grey color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
c. Hydrated Lime: ASTM C 206, Type S or ASTM C 207, Type S.
d. Aggregate: ASTM C 144, washed clean and graded natural sand passing 16-mesh sieve.
e. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2x2 W0.3/0.3 (2 in by 2 in, 16/16 wire) (50 mm by 50 mm MW2.0/2.0); comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
f. Suitable for use in thick set mortar beds up to 2 in (50 mm) thick.

C. LHT Latex-Portland Cement Mortar:

1. Material Quality Standard: ANSI A118.4 and ANSI A118.15, with the following physical properties:

a. Manufacturer's premium polymer modified LHT mortar product; gray color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
c. Non-sag capability.
d. Suitable for use in LHT mortar beds up to 1/2 in (12 mm) thick.

2. Manufacturers and Products - Floor Tiling:

a. ARDEX Engineered Cements; X 77 Microtec.
b. Custom Building Products; ProLite Tile & Stone Mortar.
c. Laticrete International, Inc.; Laticrete Tri-Lite Large and Heavy Tile Mortar.
d. Mapei Corp.; Ultraflex LFT.

e. Sika Corp.; SikaTile 500 LHT Lite.
f. Sika Corp.; Merkrete 820 Dustless Merlite.
g. Schluter Systems; All-Set.

3. Manufacturers and Products - Gauged Tile Panels / Slabs:

a. Comply with ANSI A108.19 Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar.
b. Confirm with tile manufacturer and mortar setting material manufacturers the use of required setting materials, methods and cure times.

D. Thin-Set Latex-Portland Cement Mortar (For All Tile Types Except Glass):

1. Material Quality Standard: ANSI A118.4 and ANSI A118.15, with the following physical properties:

a. Manufacturer's premium polymer modified thin-set product; gray color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
c. Non-sag capability.
d. Suitable for use in thin set mortar beds up to 1/4 in (6 mm) thick.

2. Manufacturers and Products - Floor Tiling:

a. ARDEX Engineered Cements; X 77 Microtec.
b. Custom Building Products; ProLite Tile & Stone Mortar.
c. Laticrete International, Inc.; Laticrete 254 Platinum Thin-Set Mortar.
d. Mapei Corp.; Keraflex Super Mortar.
e. Sika Corp.; SikaTile 500 LHT Lite.
f. Sika Corp.; Merkrete 820 Dustless Merlite.
g. Schluter Systems; All-Set.

3. Manufacturers and Products - Wall Tiling:

a. ARDEX Engineered Cements; X 77 Microtec.
b. Custom Building Products; ProLite Tile & Stone Mortar.
c. Laticrete International, Inc.; Laticrete Tri-Lite Large and Heavy Tile Mortar.
d. Mapei Corp.; Keraflex Super Mortar.
e. Sika Corp.; SikaTile 500 LHT Lite.
f. Sika Corp.; Merkrete 820 Dustless Merlite.
g. Schluter Systems; All-Set.

E. Thin-Set Mortar for Glass Tile:

1. Material Quality Standard: ANSI A118.4, manufacturers premium, glass tile mortar.
2. Manufacturers and Products:

a. ARDEX Engineered Cements; X 77 Microtec.
b. Custom Building Products; Glass Tile Premium Thin-Set Mortar.
c. Laticrete International, Inc.; Glass Tile Adhesive.
d. Mapei Corp.; Adesilex P10 Mosaic and Glass Tile.
e. Sika Corp.; SikaTile 300 Set.

F. Epoxy Mortar:

1. Material Quality Standard: ANSI A118.3, with the following physical properties:

a. 100 percent solids.
b. Chemical-resistant, water-cleanable, multiple component product.
c. Resistant to intermittent exposure to temperatures of up to 212 deg F. (100 deg C.).
d. Rated extra heavy service according to ASTM C 627.
e. Will not stain when used for stone tile, and acceptable to stone supplier.

2. Manufacturers and Products:

a. ARDEX Engineered Cements; WA Epoxy Grout and Adhesive.
b. Custom Building Products; EBM Lite Premium Epoxy Bonding Mortar.
c. Laticrete International, Inc.; Latapoxy 300.
d. Mapei Corp.; Kerapoxy 410.

G. Rapid Set Mortar:

1. Material Quality Standard: ANSI A108.1, manufacturers premium, rapid setting, rapid hardening, polymer-modified cement based sloping mortar for leveling and ramping substrates.
2. Manufacturer and Product:

a. Custom Building Products; SpeedSlope - Rapid Setting Sloping Mortar.
b. Mapei Corp.; Planislope RS.
c. Schluter Systems; Fast-Set.

H. Latex-Portland Cement Grout for Tile Joints:

1. Unsanded Grout:

a. Material Quality Standard: ANSI A118.7, with following physical properties:

1) Manufacturer's premium polymer modified unsanded grout product.
2) Integral antimicrobial product added during manufacturing to resist mold and mildew growth.

b. Manufacturers and Products:

1) ARDEX Engineered Cements; FG-C Unsanded Grout.
2) Custom Building Products; Prism Surecolor Grout.
3) Laticrete International, Inc.; Permacolor Grout.
4) Laticrete International, Inc.; Permacolor Select NS.
5) Mapei Corp.; Ultracolor Plus FA Grout.

c. Locations: Tile Joints less than 1/8 in (3 mm) wide.

2. Sanded Grout:

a. Material Quality Standard: ANSI A118.7, with following physical properties:

1) Manufacturer's premium polymer modified sanded grout product.
2) Integral antimicrobial product added during manufacturing to resist mold and mildew growth.

b. Manufacturers and Products:

1) ARDEX Engineered Cements; FL Rapid Set, Flexible, Sanded Grout.
2) Custom Building Products; Prism Surecolor Grout.
3) Laticrete International, Inc.; Permacolor Grout.
4) Laticrete International, Inc.; Permacolor Select Grout.
5) Mapei Corp.; Ultracolor Plus FA Grout.

c. Locations: Tile Joints 1/8 in (3 mm) wide and larger.

I. Industrial Grade Epoxy Grout:

1. Material Quality Standard: ANSI A118.3, with following physical properties:

a. 100 percent solids.
b. Chemical-resistant, water-cleanable, multiple-component product.
c. Resistant to intermittent exposure to temperatures of up to 212 deg F. (100 deg C.).
d. Mold and mildew resistant.

2. Manufacturers and Products:

a. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout.
b. Laticrete International, Inc.; SpectraLOCK 2000 IG.
c. Mapei Corp.; Kerapoxy IEG CQ.

J. Commercial Grade Epoxy Grout: High performance epoxy grout; provides high degree of stain resistance; cleanable to the original color.

1. Material Quality Standard: ANSI A118.3.
2. Manufacturers and Products:

a. Custom Building Products; CEG-Lite 100% Solids Commercial Epoxy Grout.
b. Laticrete International, Inc.; SpectraLOCK PRO Premium Grout.
c. Mapei Corp.; Kerapoxy CQ.
d. Sika Corp.; SikaTile 825 Epoxy Grout.

2.13 ELASTOMERIC SEALANTS

A. Sealant Colors: Match color of adjacent grout unless otherwise indicated.

B. Mildew-Resistant Floor or Wall Joint Sealant:

1. Material Quality Standard: ASTM C 920, Type S, Grade NS, Class 25, with following physical properties:

a. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
b. Intended for sealing interior ceramic tile joints and other nonporous substrates.
c. Resistant to in-service exposures of high humidity and temperature extremes.
d. Use Related to Exposure: T (Traffic).

2. Description: One-part mildew-resistant silicone sealant.
3. Manufacturers and Products:

a. ARDEX Engineered Cements; SX.
b. Custom Building Products; Commercial 100% Silicone Caulk.
c. Laticrete International, Inc.; Latasil.
d. Mapei Corp.; Mapesil T.
e. Sika Corp.; SikaSeal 122 MS.

C. Chemical Resistant Floor Joint Sealant:

1. Description: Two-part self-leveling epoxy sealant.
2. Manufacturers and Products:

a. Sika Corp.; Sikadur CR 190.
b. Euclid Chemical Co.; Euco 800.
c. L&M Construction Chemical Inc.; Epoflex SL.

D. Backer Rods:

1. Material Quality Standard: ASTM C 1330, Type B.
2. Description: Non-gassing (when punctured), bi-cellular polyethylene or polyolefin foam rod with a surface skin, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
3. Manufacturers and Products:
   a. Sika Corp.; MasterSeal 921.
   b. Nomaco Inc.; Sof Rod.

E. Backer Tape: Bond-breaking polyethylene or other plastic tape, self-adhesive where applicable, recommended by sealant manufacturer for preventing sealant from adhering to back of joint where such adhesion would result in sealant failure.

2.14 RELATED MATERIALS

A. Cementitious Underlayments: Trowelable or self-leveling as required by conditions; pre-mixed, latex-modified, Portland cement based formulation provided by or specifically approved by setting material manufacturer; include primers if required for concrete substrate condition.

B. Patching Compounds: Trowelable pre-mixed, latex-modified, Portland cement based formulation provided by or specifically approved by setting material manufacturer; include primers if required for concrete substrate condition.

C. Metal Transition Strips (Tile to Adjacent Flooring Material):
   1. Schluter Systems; Schiene, stainless steel.

D. Stone Threshold:
   1. Material Quality Standard: MIA Group A.
   2. Description: White marble with honed finish.
   3. Fabrication: Of shape and width to allow top at no more than 1/2 in (12 mm) above adjoining finished floor surface and both edges beveled on a slope no greater than 1:2 and as indicated in the Drawings.

E. Simulated Stone (Solid Surfacing) Threshold:
   1. Fabrication: Of shape and width to allow top at no more than 1/2 in (12 mm) above adjoining finished floor surface and both edges beveled on a slope no greater than 1:2 and as indicated in the Drawings.
   2. Color: As indicated in Division 01 Design Selections specification section(s).

F. Collapsible Shower Curb:
   1. Description: Extruded rubber profile designed to retain water within shower area but collapsing under foot or wheel weight.
   2. Basis of Design: Best Bath Systems; Collapsible Water Retainer.

G. Pre-Formed Shower Pans:
   1. Description: One piece plastic shower pan pre-pitched with integrated linear trench drain, curbs, and splash walls; surfaces ready to receive tiling.
   2. Basis of Design: Tile Redi; Redi Trench Shower Pans, sizes and configurations as indicated in the Drawings.

H. Pre-Fabricated Shower Tray, Drain and Shower Curb: Configuration as indicated on Drawings.
   1. Description: One piece expanded polystyrene (PS40) shower pan pre-pitched with integrated drain, collar, curbs and other system installation accessories; surfaces ready to receive tiling

2. Basis of Design - Shower Tray:

   a. Schluter Systems; Kerdi Shower Kit T/TS/TT with Kerdi-Drain Point Drain, brushed stainless steel, grate style as selected by Architect.
   b. Schluter Systems; Kerdi Shower Kit LT/LTS/ with Kerdi-Line Linear Drain, brushed stainless steel, grate style as selected by Architect.

3. Basis of Design - Shower Curb:

   a. Schluter Systems; Kerdi Board SC Prefabricated Waterproof Shower Curb.

I. Pre-Fabricated Niche and Corner Niches:

1. Description: High density extruded polystyrene (XPS), lightweight, waterproof, and coated with acrylic polymer finish for thin set installation of ceramic or stone tile.

   a. Manufacturers and Products: Configuration as indicated in Drawings.

      1) Noble Company; Noble Niche.
      2) Schluter Systems; Kerdi Board SN.

J. Pre-Fabricated Shower Benches:

1. Solid Bench: Expanded polystyrene (EPS), waterproof, and coated with acrylic polymer finish for thin set installation of ceramic or stone tile.

   a. Manufacturers and Products: Configuration as indicated in Drawings.

      1) Noble Company; Noble Solid Bench.
      2) Schluter Systems; Kerdi Board SB.

2. Shelf Bench: High density expanded polystyrene (XPS), lightweight, waterproof, and coated with latex modified finish on top and front and with aluminum frame, ready to install.

   a. Basis of Design: Noble Company; Noble Shelf Bench, configuration as indicated in Drawings.

K. Glass-Fiber Tape: Self-adhering, alkali-resistant, glass-fiber tape, 10 by 10 or 10 by 20 threads per 1 in (25 mm).; minimum 2 in (50 mm) wide.

L. Tile Cleaner: Neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, provided by or specifically approved by tile and grout manufacturers.

M. Grout Sealer: Manufacturers standard silicone product for sealing grout joints and that does not change color or appearance of grout.

N. Gravel Fill: Crushed stone or gravel to prevent mortar from blocking weep holes at base of drain.

2.15 MIXING MORTARS AND GROUT

A. General Procedures:

1. Mix to comply with referenced quality standards and manufacturers written instructions.
2. Add materials, water, and additives in accurate proportions.
3. Use type of mixing equipment, speeds, containers, time, and other procedures to produce uniform quality with optimum performance characteristics for installations indicated.

2.16 TILE FABRICATION FOR ARTISTIC PURPOSES

A. Cutting: Precisely cut tile into artistic design or pattern in shop using programmable computer controlled water and abrasive jet technology.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrate surfaces to which tile will be installed for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with the Contract Documents. Starting work within a particular area will be construed as acceptance.

1. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
2. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standard: In addition to standards listed elsewhere, perform tile work according to following, unless otherwise specified:

1. Respective manufacturers written installation instructions.
2. Accepted submittals.
3. Contract Documents.
4. ANSI A108 installation method indicated.
5. TCNA installation method indicated.

B. General Requirements:

1. Extend tile into recesses and under or behind equipment and fixtures to form a complete covering without interruptions unless otherwise indicated.
2. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns.
4. Perform cutting and drilling of tile without marring visible surfaces.
5. Grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints, to form smooth edges.
6. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile by not less than 1/8 in (3 mm).

C. Jointing Pattern:

1. Unless otherwise indicated, lay tile in grid pattern.
2. Align joints when adjoining tiles on floor, base, walls, and trim are same size.
3. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting.
4. Provide uniform joint widths of size recommended by tile and grout manufacturer unless otherwise indicated.
5. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.

D. Wainscots: Lay out tile to next full tile beyond dimensions indicated, and finish with bullnose shape.

3.3 PREPARATION

A. General: Comply with manufacturers instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Substrate Cleaning: Remove curing compounds, coatings, laitance, efflorescence, concrete dust, dirt, oil, gypsum board dust, paint, and other residue that would adversely affect or reduce bonding.

C. Concrete Floor Preparation:

1. Prepare concrete floor substrates to comply with flatness tolerance of 1/4 in in 10 ft (6 mm in 3 m). Comply with more restrictive flatness tolerances when recommended or required by manufacturer.

a. Fill cracks, holes and depressions with trowelable cementitious underlayments and patching compounds.
b. Remove concrete protrusions, bumps, and ridges by sanding or grinding.

2. If substrate does not have fine broom finish, mechanically scarify concrete substrates to not less than ICRI CSP 4 finish.
3. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 in per foot (1:50) toward drains.

D. Substrate Joints, Gaps, Penetrations, and Different Substrates within Shower and Tub Enclosures: Prior to installing tile, seal the following joints, gaps, and spaces between differing materials as follows:

1. Base of Wall Joints within Shower and Tub Enclosures: Apply wall joint sealant at joint between Coated Glass-Mat Water Resistant Board (specified in Division 09 Section Gypsum Board Assemblies) and Tub Enclosure or Prefabricated Shower Receptor, Thick-set Mortar Bed, or floor slab to create water resistant barrier in accordance with TCNA Installation B420.
2. Penetrations: Apply wall joint sealant at penetrations through wall substrates to create water resistant barrier; especially at piping and valve penetrations.
3. Toilet Accessories: Apply wall joint sealant at fastener penetrations and around perimeter of backing plates to create water resistant barrier.
4. Joints and Corners: Apply glass-fiber tape to joints and corners of substrates within Showers and Tub Enclosures with thin-set mortar.

E. Blending: Verify tile has been factory blended and packaged as specified; if not, either return to manufacturer or blend tiles at site before installing.

F. Field-Applied Temporary Protective Coating: Where needed to prevent grout from staining or adhering to exposed tile surfaces, pre-coat with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.4 WATERPROOF MEMBRANE UNDERLAYMENT INSTALLATION

A. Installation Quality Standard: ANSI A108.13 and manufacturers written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. General Requirements:

1. If required by manufacturer, prime concrete substrate.

2. Install to produce a continuous waterproof membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles or kinks.
3. For sheets, overlap and seal seams.
4. Turn membrane up wall at locations where tile is scheduled for wall or base.
5. Roll installed sheet if required by manufacturer.
6. Install tile after waterproofing has cured and been tested determined it is watertight.

3.5 CRACK ISOLATION MEMBRANE UNDERLAYMENT INSTALLATION

A. General Requirements:

1. If required by manufacturer, prime concrete substrate.
2. Install to produce a continuous crack isolation membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles, or kinks.
3. For sheets, overlap and seal seams.
4. For liquid applied products, brush or roll liquid uniformly over area in number of coats required and install reinforcing fabric.
5. Roll installed sheet if required by manufacturer.
6. After installation of tile, install floor joint sealant in tile joints recommended by manufacturer to coordinate with membrane strips.

3.6 SOUND REDUCTION MEMBRANE UNDERLAYMENT INSTALLATION

A. General Requirements:

1. If required by manufacturer, prime concrete substrate.
2. Install to produce a continuous sound reduction membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles, or kinks.
3. For sheets, overlap and seal seams.
4. For liquid applied products, brush or roll liquid uniformly over area in number of coats required.
5. Roll installed sheet if required by manufacturer.

3.7 PREFORMED SHOWER PAN INSTALLATION

A. Comply with manufacturer written installation instructions. Evenly spread mortar bed over entire shower enclosure substrate. Provide mortar thickness as needed to ensure entire underside of pan profile is continuously in contact with mortar bed without void spaces below pan.

3.8 TILE INSTALLATION

A. Comply with TCNAs Handbook for Ceramic Tile Installation for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series Specifications for Installation of Ceramic Tile that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Installation Quality Standard: Install tile according to following standards:

1. Thick-set Mortar: ANSI A108.1 and A108.5; for recessed subfloor.
2. LHT Mortar: ANSI A108.5; for floor tiles larger than 8 in by 8 in (200 mm by 200 mm) or with at least one side greater than 15 in (375 mm) and where subfloor is not recessed.

   a. For tile with one side greater than 15-inches (375 mm), the maximum allowable subfloor surface variation is 1/8-inch in 10 feet (3mm in 3m) and 1/16-inch in 2 feet (1.6mm in 0.6m) from the required plane when measured from the high points in the subfloor surface.

3. Thin-set Latex-Portland Cement Mortar: ANSI A108.5; for floor tiles 8 in by 8 in (200 mm by 200 mm) and smaller where subfloor is not recessed; and for interior wall tiles.
4. Epoxy Mortar: ANSI A108.9.
5. Latex-Portland Grout: ANSI A108.10, typical unless indicated otherwise.
6. Epoxy Grout: ANSI A108.9, where indicated.
7. Interior Gauged Porcelain Tiles and Panels/Slabs: A108.19

C. Back Buttering: For following installations, obtain minimum 95 percent mortar coverage as in referenced ANSI A108 series of installation standards:

1. Exterior tile floors.
2. Tile floors and ceilings in wet and limited water exposures.
3. Tile floors installed with epoxy mortars.
4. Tile floors composed of tiles 12 in by 12 in (300 mm by 300 mm) or larger.
5. Tile floors composed of rib-backed tiles.

D. Grout Joint Widths: Unless indicated otherwise, install the respective types of tile with the following grout joint widths, unless otherwise recommended by tiling and grout manufacturers.

1. Ceramic Mosaic Tile - Less than 6 sq in (3900 mm²): 1/16 in (1.5 mm).
2. Paver Tile - 6 sq in (3900 mm²) or More: 1/4 in (6 mm).
3. Quarry Tile - 6 sq in (3900 mm²) or More: 1/4 in (6 mm).
4. Stone Tile: 1/4 in (6 mm).

E. Stone Thresholds: Install at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated. Where edge of mortar bed would be exposed, set in thin-set mortar.

F. Simulated Stone (Solid Surfacing) Thresholds: Install at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated. Where edge of mortar bed would be exposed, set in thin-set mortar.

G. Metal Trim: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

H. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.9 MOVEMENT JOINTS

A. Movement Joints, General: Installation Quality Standard: In accordance with TCNA Movement Joint Design Essentials EJ171 and as specified below.

B. Wall Joints: The following conditions shall not be grouted; install wall joint sealant and backer rod or backer tape:

1. Gypsum board assembly control joints.
2. Building expansion joints, unless scheduled for expansion joint cover.
3. Interior corners of tiled walls, including shower and bathtub walls.
4. Around substrates and tile at penetrations through tiled substrates.
5. At one side of changes in direction or plane of wall.
6. At joint closest and parallel to changes in substrates supporting tile between wall and floor.

C. Floor Joints:

1. General Requirements:

a. Where full coverage crack isolation membrane is not provided, continue construction, contraction (control), and expansion joints in building structure through tile work.
b. Isolate tile work that abuts a restraining structure or assembly.
c. When metal trim or sealant/backer is used for joint, width shall not be less than width of joint in building structure.
d. Tile shall not be placed over building expansion joints.

2. Schedule of Sealant Products and Locations:

a. Latex-Portland Cement Grouted Floors: Install floor joint sealant with backer rod at horizontal joints in mortar and grout setting conditions.
b. Epoxy Grouted Floors: Install chemical resistant floor joint sealant full depth without backer rod at horizontal joints in epoxy grout setting conditions.
c. Epoxy Mortar and Grouted Floors: Install chemical resistant floor joint sealant full depth without backer rod at horizontal joints in epoxy mortar and grout setting conditions.

3. Interior Movement Joint Spacing: As indicated on Drawings and as specified below:

a. Tile Exposed to Direct Sunlight or Moisture: 8 ft to 12 ft (2.4 m to 3.6 m) on center each way,1/4-inch wide unless indicated otherwise.
b. Tile Not Exposed to Sunlight: 20 ft to 25 ft (6 m to 7.5 m) on center each way,1/4-inch wide unless indicated otherwise.

D. Interior Floor Joint Installation Schedule: Seal interior floor movement joints, as defined by TCNA, according to following schedule:

1. Construction Joints: Floor joint sealant and backer rod.
2. Contraction (Control) Joints: Floor joint sealant and backer rod.
3. Isolation Joints: Floor joint sealant and backer rod.
4. Tile Expansion Joints: Floor joint sealant and backer rod.
5. Perimeter Joints between Wall and Floors: Floor joint sealant with backer tape.

3.10 FIELD QUALITY CONTROL

A. Owner Acoustical Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Testing and inspections may include the following.

1. Airborne-Sound Testing, Horizontal and Vertical: Perform testing of installed assemblies for noise isolation in accordance with ASTM E 336 Standard Test Method from Measurement of Airborne Sound Attenuation between Rooms in Buildings, ASTC (Apparent Sound Transmission Class) determined by ASTM E413 Classification for Rating Sound Insulation.

a. Extent of Testing: Testing agency shall randomly select assemblies for testing.

2. Structure-Borne Sound Testing, Vertical: Perform testing of installed assemblies for noise isolation in accordance with ASTM E 1007 Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission through Floor-Ceiling Assemblies and Associated Support Structures, AIIC (Apparent Impact Isolation Class) determined by ASTM E989 Standard Classification for Determination of Single-Number Metrics for Impact Noise.

a. Extent of Testing: Testing agency shall randomly select assemblies for testing.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:
   a. Materials and installation will be considered defective if they do not meet specified requirements.
   b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
   c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
2. Prepare test and inspection reports.

C. Contractor Shower Receptor Test: Where shower floors and receptors are made water-tight by the application of the waterproof membrane, the completed membrane installation shall be tested at each installation.

1. The pipe from the shower drain shall be plugged and the receptor area shall be filled with water to a depth of not less than 2 in (50 mm) measured at the threshold.
2. Where a threshold of adequate height does not exist a temporary threshold shall be constructed to retain the test water to the stated depth.
3. The water shall be retained for a test period of not less than 24 hours, and there shall not be evidence of leakage.
4. Report results of tests, both successful and unsuccessful. In addition to results, report shall include date of test, project name, list of products being applied and tested, name of applicator, name of Contractor, and conditions causing failure of waterproofing membrane in event of an unsuccessful test.
5. Materials and installations failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

3.11 CLEANING

A. Cleaning:

1. Acids are not permitted, nor will they be allowed.
2. Clean tile surfaces so they are free of foreign matter.
3. Remove grout residue from tile as soon as possible.
4. No sooner than 10 days after installation, clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned.
5. Protect metal surfaces and plumbing fixtures from effects of cleaning.
6. Flush surfaces with clean water before and after cleaning.
7. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

3.12 DEMONSTRATION

A. Cleaning and Maintenance Training: Provide instruction to Owner's personnel for cleaning and maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use; include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

3.13 PROTECTION

A. Coverings: When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy

covering during construction period to prevent staining, damage, and wear. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

B. Traffic Restrictions: Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

3.14 EXTERIOR TILE INSTALLATION SCHEDULE

A. Roofs, Walking Surfaces, and Plazas Over Occupied Areas, Concrete Substrate - Recessed:

1. TCNA Installation Method F103 (Waterproof Membrane): Thick-set reinforced Portland cement mortar bed over waterproof membrane over concrete subfloor; Latex-Portland cement grout.

a. Waterproof Membrane: Refer to Division 07 Section Hot Fluid Applied Rubberized Asphalt Waterproofing.

B. Floors, Walking Surfaces, and Plazas over Slab on Grade Areas, Concrete Substrate - Recessed:

1. TNCA Installation Method F101 (Bonded): Thick-set non-reinforced Portland cement mortar bed over concrete subfloor; Latex-Portland cement grout.

C. Floors, Walking Surfaces, and Plazas over Slab on Grade Areas, Concrete Substrate:

1. TNCA Installation Method F102 (Bonded): LHT Latex-Portland cement mortar over concrete subfloor; Latex-Portland cement grout.

D. Balconies Over Occupied Areas, Concrete Substrate:

1. TCNA Installation Method F104 (Waterproof Membrane): LHT Portland cement mortar bed over waterproof membrane over concrete subfloor; Latex-Portland cement grout.

E. Balconies Over Occupied Areas, Concrete Substrate - Split Slab with Hot Fluid-Applied Waterproofing:

1. Refer to Division 07 Section Hot Fluid Applied Rubberized Asphalt Waterproofing and Division 3 Section for concrete topping at split slab construction.
2. TCNA Installation Method F104 (Fluid Applied Crack Isolation Membrane): LHT Portland cement mortar bed over crack suppression membrane over concrete subfloor; Latex-Portland Cement Grout.

F. Balconies Over Unconditioned or Open Balcony Areas, Concrete Substrate:

1. TCNA Installation Method F104 (Fluid Applied Crack Isolation Membrane): LHT Portland cement mortar bed over crack suppression membrane over concrete subfloor; Latex-Portland Cement Grout.

G. Balconies Over Unconditioned or Open Balcony Areas, Concrete Substrate:

1. TCNA Installation Method F104 (Waterproof Membrane): LHT Latex-Portland cement mortar over waterproof membrane over concrete subfloor; Latex-Portland Cement Grout.

H. Exterior Wall Tiling:

1. Refer to Division 04 Section Adhered Masonry Veneer.

3.15 INTERIOR TILE INSTALLATION SCHEDULE

A. Floors, Concrete Substrate - Recessed:

1. TCNA Installation Method F111 (Cleavage Membrane) at Slabs-on-Grade: Thick-set reinforced Portland cement mortar bed over cleavage membrane over concrete subfloor; Latex-Portland Cement Grout.
2. TCNA Installation Method F121 (Waterproof Membrane) at Elevated Slabs: Thick-set reinforced Portland cement mortar bed over waterproof membrane over concrete subfloor; Latex-Portland Cement Grout.
3. TCNA Installation Method F121 (Sound Reduction Membrane) at Elevated Slabs: Thick-set reinforced Portland cement mortar bed over sound reduction membrane over concrete subfloor; Latex-Portland Cement Grout.

B. Floors, Kitchens, and Food Service Areas, Concrete Substrate - Recessed:

1. TCNA Installation Method F114 (Cleavage Membrane) at Slabs-on-Grade: Thick-set reinforced Portland cement mortar bed over cleavage membrane over concrete subfloor; Industrial Grade Epoxy Grout.
2. TCNA Installation Method F114 (Waterproof Membrane) at Elevated Slabs: Thick-set reinforced Portland cement mortar bed over waterproof membrane over concrete subfloor; Industrial Grade Epoxy Grout.

C. Floors, Kitchens, and Food Service Areas, Concrete Substrate - LHT Mortar:

1. TCNA Installation Method F115 (Crack Isolation Membrane; Full Coverage) at Slabs-on-Grade: Latex-Portland cement mortar bond coat over crack isolation membrane over concrete sublfoor; Industrial Grade Epoxy Grout.
2. TCNA Installation Method F115A (Waterproof Membrane) at Elevated Slabs: Latex-Portland cement mortar bond coat over waterproof membrane over concrete sublfoor; Industrial Grade Epoxy Grout.

D. Floors, Kitchens, and Food Service Areas, Concrete Substrate - Epoxy Mortar:

1. TCNA Installation Method F131 (Crack Isolation Membrane; Full Coverage) at Slabs on Grade: Epoxy mortar bond coat over crack isolation membrane over concrete sublfoor; Industrial Grade Epoxy Grout.

   a. Epoxy mortar manufacturer shall confirm compatibility of mortar and crack isolation membrane in writing.

2. TCNA Installation Method F131 (Waterproof Membrane) at Elevated Slabs: Epoxy mortar bond coat over waterproof membrane over concrete sublfoor; Industrial Grade Epoxy Grout.

   a. Epoxy mortar manufacturer shall confirm compatibility of mortar and waterproof membrane in writing.

E. Floors, Concrete Substrate:

1. TCNA Installation Method F125-Full (Crack Isolation Membrane; Full Coverage): Thin-set Latex-Portland cement mortar over crack isolation membrane over concrete subfloor; Latex-Portland Cement Grout.

   a. Location: Where scheduled in the Room Finish Schedule or located on the drawings and in all thin-set tile locations having neither waterproofing nor sound isolation scheduled.

2. TCNA Installation Method F125-Partial (Crack Isolation Membrane; Partial Coverage Only at Visible Cracks in Substrate): Thin-set Latex-Portland cement mortar over crack isolation membrane over concrete subfloor; Latex-Portland Cement Grout.

a. Location: Where scheduled in the Room Finish Schedule or located on the drawings and in all thin-set tile locations which have neither waterproofing nor sound isolation scheduled.

3. TCNA Installation Method F122 (Waterproof Membrane): Thin-set Latex-Portland cement mortar over waterproof membrane over concrete subfloor; Latex-Portland Cement Grout.

a. Location: As scheduled in the Room Finish Schedule or located on the drawings.

4. TCNA Installation Method F122 (Sound Reduction Membrane): Thin-set Latex-Portland cement mortar over sound reduction membrane over concrete subfloor; Latex-Portland Cement Grout.

a. Location: As scheduled in the Room Finish Schedule or located on the drawings.

F. Floors, Elevator Car, Cementitious Backer Unit Substrate:

1. TCNA Installation Method F144 (Crack Isolation Membrane; Full Coverage): Epoxy mortar over crack isolation membrane over cementitious backer unit; Commercial Epoxy Grout.

G. Walls and Floors, Gauged Porcelain Tile Panels and Slabs:

1. ANSI A 108.19 Interior Installation of Gauged Porcelain Tile and Gauged Porcelain Tile Panels/Slabs (Material and Installation Standards), 2017 or Current Version.

H. Walls, Gypsum Board Substrate:

1. TCNA Installation Method W243: Thin-set Latex-Portland cement mortar over coated-glass-mat gypsum board; Latex-Portland Cement Grout.

I. Walls, Concrete or Masonry Substrate:

1. TCNA Installation Method W202: Thin-set Latex-Portland cement mortar over concrete or masonry; Latex-Portland Cement Grout.

J. Walls, Gypsum Board Substrate, Bathtub / Shower Surfaces:

1. Walls, Including Tub Unit or Pre-Fabricated Shower Receptors: TCNA Installation Method B419 (Waterproof Membrane): Thin-set Latex-Portland cement mortar over waterproof membrane over coated-glass-mat gypsum board; Latex-Portland Cement Grout.
2. Shower Receptors: TCNA Installation Method B420 (Waterproof Membrane): Thin-set Latex-Portland cement mortar over waterproof membrane over coated-glass-mat gypsum board walls and concrete subfloors; Latex-Portland Cement Grout.

K. Cementitious Backer Unit Substrate, Saunas, Steam Rooms, Gang Showers, and Pool Enclosure Surfaces:

1. Walls and Ceilings: TCNA Installation Method SR614 (Waterproof Membrane): Thin-set Latex-Portland cement mortar over waterproofing membrane over cementitious backer units; Epoxy Grout.
2. Floors: TCNA Installation Method SR614 (Waterproof Membrane): Thick-set Latex-Portland cement mortar bed over waterproof membrane over concrete subfloor; Epoxy Grout.

3.16 TILE FINISH SCHEDULE

A. T-01:

1. Type: Ceramic Wall and Floor Tile.
2. Manufacturer / Supplier:
3. Style Name and Number:
4. Color Name and Number:
5. Size: in by in by in (mm by mm by mm) thick.
6. Pattern: As indicated on the Drawings.
7. Grout Color:

   a. Manufacturer:
   b. Color Name and Number:

8. Trim: Provide tile trim and accessories that match color and finish of adjoining flat tile as required to prevent unfinished edges of tile from being exposed to view.

B. T-02:

1. Type: Porcelain Ceramic Wall and Floor Tile.
2. Manufacturer / Supplier:
3. Style Name and Number:
4. Color Name and Number:
5. Size: in by in by in (mm by mm by mm) thick.
6. Pattern: As indicated on the Drawings.
7. Grout Color:

   a. Manufacturer:
   b. Color Name and Number:

8. Trim: Provide tile trim and accessories that match color and finish of adjoining flat tile as required to prevent unfinished edges of tile from being exposed to view.

C. T-03:

1. Type: Stone Wall and Floor Tile.
2. Manufacturer / Supplier:
3. Name and Number:
4. Finish: FILL IN finish
5. Size: in by in by in (mm by mm by mm) thick.
6. Pattern: As indicated on the Drawings.
7. Edges: Square with eased exposed corner.
8. Grout Color:

   a. Manufacturer:
   b. Color Name and Number:

9. Trim: Provide tile trim and accessories that match color and finish of adjoining flat tile as required to prevent unfinished edges of tile from being exposed to view.

D. T-04:

1. Type: Terrazzo Floor Tile.
2. Manufacturer / Supplier:
3. Style Name and Number:
4. Color Name and Number:
5. Size: in by in by in (mm by mm by mm) thick.
6. Pattern: As indicated on the Drawings.
7. Edges: Square with eased exposed corner.
8. Grout Color:

   a. Manufacturer:

b. Color Name and Number:

9. Trim: Provide tile trim and accessories that match color and finish of adjoining flat tile as required to prevent unfinished edges of tile from being exposed to view.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 095113
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical lay-in ceiling panels, exposed metal suspension systems, and supplementary items necessary for installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS FOR SUSPENDED CEILING ASSEMBLIES WITHSTANDING SEISMIC LOADS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings for Engineered Suspended Ceiling Assemblies - Seismic Loads: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work showing suspended ceiling assemblies required to support

concentrated loads; include seal and signature of delegated engineering professional responsible for their preparation.

C. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

D. Samples for Verification Purposes: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. Acoustical Panels: Set of 6 in (150 mm) square samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 12 in (300 mm) long samples of each type, finish, and color.
3. Clips: Full size clips.

1.4 INFORMATIONAL SUBMITTALS

A. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.

   a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

   a. Lighting fixtures.
   b. Diffusers.
   c. Grilles.
   d. Speakers.
   e. Sprinklers.
   f. Access panels.
   g. Perimeter moldings.

7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic

effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
   a. Show typical components, attachments to building structure, and requirements of installation.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering product may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic / Rockfon.
4. Lindner Ceiling Systems.
5. OWA USA.
6. USG Interiors, Inc.; Subsidiary of USG Corporation.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Obtain both acoustical ceiling panels and suspension system from the same manufacturer if both are offered by the manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 450 or less.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

D. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

E. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined in accordance with the building code and authorities having jurisdiction.

1. ASCE/SEI 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

2. ASTM E 580 / E 580M, Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

F. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, and other detrimental effects.

2.4 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance's, unless otherwise indicated.

1. Selections: As scheduled or as indicated in Design Selections.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times design load indicated in ASTM C 635/C 635, Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Cast-in-place anchors, designed for attachment to concrete.
b. Post-installed expansion anchors.
c. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 for Class SC1 service condition.

2. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.

a. Manufacturers:

1) Construction Materials, Inc.
2) Heckman Building Products, Inc.
3) Hilti Corp.
4) ITW Ramset/Red Head.
5) Powers Fasteners.

6) Simpson Strong Tie Anchor Systems.

3. For post-tensioned concrete, anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Wire:

a. Zinc-Coated Carbon-Steel Wire: ASTM A 641 / A 641M, Class 1 zinc coating, soft temper.
b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic; for use at MRI and related spaces.

2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635/C 635M, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106 in (2.69 mm) diameter wire.

E. Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces and complying with requirements of authorities having jurisdiction or as recommended by manufacturer.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces and complying with requirements of authorities having jurisdiction.

G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place and complying with requirements of authorities having jurisdiction.

H. Hold-Down Clips: Where indicated, provide manufacturer standard hold-down clips spaced 24 in (600 mm) on center on all cross tees.

I. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

J. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including manufacturer's standard gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.

K. Clean-Room Sealant for Concealed Joints: Manufacturer's standard nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Edge Moldings and Trim: Manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
4. Where required by Code or authorities having jurisdiction, provide 2 in (50 mm) wide wall angle around the ceiling perimeter in Seismic Design Categories D, E, and F.
5. Round Column Angle Molding:

a. Basis of Design: Fry Reglet Corporation; "Column Collar", extruded aluminum with PVC spacer, size as required for column diameter, finish to match suspension system.

B. Specialty Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
2. Basis of Design (Product Standard) Manufacturer and Product: Armstrong World Industries, Inc.; Axiom series, with manufacturer's 30 year warranty.

a. Classic Trim.
b. Soft Edge.
c. Vector.
d. Knife Edge Trim.
e. Drywall Trim.
f. Transitions.
g. Glazing Channel Trim.
h. Building Perimeter System.

2.7 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILINGS

A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653 / A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16 in (24 mm) wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. Structural Classification: Heavy-duty system.
3. End Condition of Cross Runners: Override (stepped) type.
4. Face Design: Flush face.
5. Cap Material: Steel sheet.
6. Cap Finish: Painted white, unless indicated otherwise.
7. Manufacturers and Products:

a. Armstrong World Industries, Inc.; Prelude XL.
b. CertainTeed Corporation; Classic Stab.
c. Chicago Metallic / Rockfon.; 1200 System.
d. USG Interiors, Inc.; Donn DX.

8. Manufacturers and Products:

a. Armstrong World Industries, Inc.; Prelude XL Fire Guard; fire-rated.
b. CertainTeed Corporation; Protectone Classic Fire-Rated.
c. Chicago Metallic / Rockfon.; 1250 Fire-Front System; fire-rated.
d. USG Interiors, Inc.; Donn DXL; fire-rated.

B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653 / A 653M, not less than G30 (Z90) coating designation, with prefinished 9/16 in (15 mm) wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. Structural Classification: Heavy-duty system.

3. End Condition of Cross Runners: Override (stepped) type.
4. Face Design: Flush face.
5. Cap Material: Steel sheet.
6. Cap Finish: Painted white, unless indicated otherwise.
7. Manufacturers and Products:
    a. Armstrong World Industries, Inc.; Suprafine XL.
    b. CertainTeed Corporation; Elite Narrow Stab.
    c. Chicago Metallic / Rockfon.; 4000 Tempra.
    d. USG Interiors, Inc.; Donn Centricitee DXT.
8. Manufacturers and Products:
    a. Armstrong World Industries, Inc.; Suprafine XL Fire Guard; fire-rated.
    b. Chicago Metallic / Rockfon.; 4050 Tempra; fire-rated.
    c. USG Interiors, Inc.; Donn Centricitee DXT.

C. Wide-Face, Capped, Double-Web Aluminum Suspension System: Main and cross runners roll formed from cold-rolled aluminum sheet, with prefinished 15/16 in (24 mm) wide aluminum caps on flanges.

1. Structural Classification: Light-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flush face.
4. Cap Material: Aluminum sheet.
5. Cap Finish: Painted white, unless indicated otherwise.
6. Manufacturers and Products:
    a. Armstrong World Industries, Inc.; AL Prelude Plus XL.
    b. Chicago Metallic / Rockfon.; 830 All Aluminum.
    c. USG Interiors, Inc.; Donn AX.

D. Narrow-Face, Slotted, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653 / A 653M, not less than G30 (Z90) coating designation, with prefinished 9/16 in (15 mm) wide metal box-shaped flanges.

1. Structural Classification: Intermediate-duty system.
2. Structural Classification: Heavy-duty system.
3. Face Design: With 1/8 in (3 mm) wide, slotted, box-shaped flange.
4. Face Design: With 1/4 in (6 mm) wide, slotted, box-shaped flange.
5. Cap Finish: Painted white, unless indicated otherwise.
6. Reveal Finish: Painted to match flange color.
7. Manufacturers and Products:
    a. Armstrong World Industries, Inc.; Silhouette XL 1/8.
    b. Chicago Metallic / Rockfon.; 3600 Ultraline with 1/8" Reveal.
    c. USG Interiors Inc.; Donn Fineline DXFF (with 1/8" Reveal).
8. Manufacturers and Products:
    a. Armstrong World Industries, Inc.; Silhouette XL 1/4.
    b. CertainTeed Corporation; Smoothline Bolt Slot System (with 1/4" Reveal).
    c. Chicago Metallic / Rockfon.; 3500 Ultraline with 1/4" Reveal.
    d. USG Interiors Inc.; Donn Fineline DXF (with 1/4" Reveal).

E. Wide-Face, Capped, Double-Web, Stainless Steel Suspension System: Main and cross runners roll formed from cold-rolled Type 304 or 316 non-magnetic stainless steel sheet, standard of manufacturer, with 15/16 in (24 mm) wide polished stainless steel caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flush face.
4. Cap Material: Polished stainless steel sheet.
5. Manufacturers and Products:

    a. Armstrong World Industries, Inc.; SS Prelude Plus XL.
    b. Chicago Metallic / Rockfon.; 730 System - All Stainless Steel.
    c. USG Interiors, Inc.; Donn DXSS.

F. Wide-Face, Fiber-Reinforced Plastic (FRP) Suspension System: Main and cross runners extruded from Grade 1, Type 2 virgin polyvinyl chloride (PVC), with 1-3/8 in (35 mm) wide flanges.

1. Structural Classification: Light-duty system (main tees at 4'-0" on center).
2. Structural Classification: Intermediate-duty system (main tees at 3'-6" on center).
3. Accessories: Provide manufacturer's standard splice and connection clips for attachment of suspension system members.
4. Basis of Design: Chicago Metallic / Rockfon.; DynaGlass FRP.

G. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653 / A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16 in (24 mm) wide, aluminum caps on flanges.

1. Structural Classification: Intermediate-duty or Heavy-duty system, standard of manufacturer.
2. Structural Classification: Heavy-duty system.
3. End Condition of Cross Runners: Override (stepped) type.
4. Face Design: Flush face.
5. Cap Material: Aluminum sheet.
6. Cap Finish: Painted white, unless indicated otherwise.
7. Cap Finish: Clear anodized.
8. Manufacturers and Products:

    a. Armstrong World Industries Inc.; Prelude Plus XL Fire Guard.
    b. CertainTeed Corporation; FireSecure 15/16" Classic Environmental Stab System.
    c. Chicago Metallic / Rockfon.; 1830 HDG-60 Steel with Aluminum Cap.
    d. USG Interiors Inc.; ZXLA.

9. Manufacturers and Products:

    a. Armstrong World Industries Inc.; Prelude Plus XL Fire Guard.
    b. CertainTeed Corporation; FireSecure 15/16" Classic Environmental Stab System.
    c. USG Interiors Inc.; ZXLA.

H. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G90 (Z275), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653 / A 653M, G90 (Z275) coating designation, with prefinished, cold-rolled, 15/16 in (24 mm) wide, aluminum caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flush face.
4. Cap Material: Aluminum sheet.
5. Cap Finish: Painted white, unless indicated otherwise.
6. Basis of Design: Armstrong World Industries Inc.; Prelude XL 15/16" Exposed Tee System for Exterior Applications.

2.8 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Division 7 Section Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.4 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

A. Installation Quality Standard: Install acoustical ceiling panels according the following standards, seismic design requirements and manufacturer's written instructions.

1. ASTM C 636 / C 636M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
2. ASCE/SEI 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
3. ASTM E 580 / E 580M, Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with mechanical and electrical equipment, insulation, or other objects within ceiling plenum that are not part of supporting structural frame or ceiling suspension system.
2. Within limitations allowed by installation quality standards, splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard

suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by installation quality standards.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms. Fasten hangers to cast-in-place hanger inserts, power-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 in (1200 mm) on center along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 in (200 mm) from ends of each member.
9. Do not connect or suspend any ceiling components from ducts, pipes or conduit.
10. Do not make local kinks or bends in hanger wires as a means of leveling.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors. Install compression struts to meet seismic requirements.

D. Install edge moldings and trim at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 in (400 mm) on center and not more than 3 in (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 in per 12 ft (3 mm per 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
4. Provide control joints where joints occur in abutting surfaces.
5. Hold tees in place with concealed clips.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

1. Space steel main runners at 48 in (1200 mm) on center.
2. Space aluminum main runners at 24 in (600 mm) on center.

F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels with pattern running in one direction parallel to long axis of space.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Hold-Down Clips: Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.
7. Impact Clips: Install impact clips in areas indicated; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.
8. Clean Room Installations: Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
9. Fire-Resistance-Rated Ceiling Assemblies: Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated ceiling assembly.

G. Exterior Installations: Install exterior suspension system with hold down clips and compression struts.

1. Fasten struts to suspension system and to structure above.
2. Space struts along each main beam at 96 in (2400 mm) on center.
3. Stagger strut spacing by 48 in (1200 mm) along alternating main beams.
4. Provide additional struts at extreme wind up-lift locations.
5. Hold lay-in panels in place with a minimum of four hold-down clips per panel.
6. Provide additional hold-down clips where acoustical panels do not fit snug to system flanges and at extreme wind up-lift locations.

3.5 FIELD QUALITY CONTROL

A. Owner Testing Agency: The Owner will employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

1. Periodic inspection during the installation of suspended ceiling grids according to the building code and authorities having jurisdiction.

3.6 PROTECTION

A. Protect products and systems from damage during installation and remainder of construction period according to manufacturer's instructions.

3.7 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.8 ACOUSTICAL PANEL CEILING SCHEDULE

A. Type ACT01:

1. Manufacturer and Series:
2. Style:
3. Size:

4. Item No.:
5. Color:
6. Edge Detail:
7. Grid System:

B. Type ACT01: As selected by Architect from full range of industry patterns.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 095133
SUSPENDED METAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Suspended metal ceilings, metal suspension systems, and supplementary items necessary for installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS FOR CEILING ASSEMBLIES WITHSTANDING SEISMIC LOADS OR WIND LOADS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Metal pans for metal ceilings.
2. Suspension system for metal ceilings.

B. Shop Drawings: For metal ceilings.

1. Include reflected ceiling plans, sections, and details drawn to scale, showing the following items and coordinated with each other, using input from installers of the items involved:
    a. Ceiling patterns and joints.
    b. Suspension system components.
    c. Method of attaching hangers to building structure and locations of cast-in-place anchors, clips, and other ceiling attachment devices.
    d. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
    e. Size and location of initial access modules.
    f. Ceiling-mounted items including, but not limited to, light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
    g. Ceiling perimeter and penetrations through ceiling; trim and moldings.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below:
1. Metal Pans: Set of 12-inch- (300-mm-) samples of each type, finish, color, pattern, and texture. Show pan edge profile and splices when applicable.
2. Suspension-System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.
3. Exposed Molding, Trim, Filler and Caps: Set of 12-inch- (300-mm-) long samples of each type, finish, and color.
4. Sound Absorber: Sample of each type matching size of Sample metal pan.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

D. Evaluation Reports: For metal ceiling suspension systems.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Materials: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Metal Pans: Full-size units equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each grid, exposed molding, and trim equal to 2percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.8 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal pans, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle metal pans, suspension-system components, and accessories carefully to avoid damaging units and finishes in any way.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCT

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering product may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Armstrong World Industries, Inc.
2. Ceilings Plus.
3. Chicago Metallic Corporation
4. Gordon, Inc.
5. Hunter Douglas Architectural Products, Inc.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS FOR CEILING ASSEMBLIES WITHSTANDING SEISMIC LOADS OR WIND LOADS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

C. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined in accordance with the building code and authorities having jurisdiction.

1. ASCE/SEI 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
2. ASTM E 580 / E 580M, Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

D. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, and other detrimental effects.

2.4 METAL PANS, GENERAL

A. Metal Panel Standard: Provide manufacturer's standard pans of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.

B. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.

1. Aluminum Sheet: Rolled aluminum sheet, complying with ASTM B209 (ASTM B209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

a. Pan Thickness: Manufacturer standard for pan material, profile not less than 0.040 inch (1.0 mm).

2. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C635/C635M.

a. Pan Thickness: Not less than 0.030 inch (0.75 mm).

1) Painted Finishes: Electrolytic zinc-coated steel complying with ASTM A879/A879M, 13Z (40G) coating, surface treatment as recommended by finish manufacturer for type of use and finish indicated.
2) Chemical/Mechanical Finishes: Uncoated steel sheet complying with ASTM A1008/A1008M with luster or bright finish as required by finisher for applying electroplating or other metallic-finishing processes.

3. Stainless Steel Sheet: Complying with ASTM A240/A240M or ASTM A666, Type 304 or Type 430.

a. Pan Thickness: Not less than 0.030 inch (0.76 mm) nominal.

C. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing in accordance with ASTM E84.

1. Bond fabric layer to panels in the factory with manufacturer's standard nonflammable adhesive.

D. Sound-Absorbent Pads: Provide width and length to completely fill concealed surface of pan, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing in accordance with ASTM E84, and to comply with the following requirements:

1. Plastic Sheet-Wrapped, Mineral-Fiber Insulation: Where recommended by the Manufacturer, pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C553, Type I, Type II, or Type III, and as follows:
2. Unwrapped, Glass-Fiber Insulation: Black coated, unfaced, complying with ASTM C553, Type I, Type II, or Type III; treated to be nondusting; thickness as required to achieve performance requirements indicated.
3. Spacer Grids: Provide manufacturer's standard grid units that provide an air cushion between metal pans and insulation pads and that act to improve sound absorption.

E. Adhesive: Manufacturer's standard nonflammable adhesive for sound-absorbent fabric or pads.

2.5 METAL PAN CEILINGS, INTERIOR

A. Metal Pan Ceiling, Interior:

1. Basis of Design Manufacturer and Product:

a. Armstrong World Industries; Metalworks

b. Panel Selection and Finish: As scheduled or indicated in Design Selections.
c. NRC: Unless scheduled or indicated otherwise, not less than 0.70 when tested in accordance with ASTM C423.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Pan Fabrication: Manufacturer's standard, size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.

D. Pan Edge Detail: Manufacturer's standard edge detail.

E. Pan Joint Detail: As indicated on Drawings.

F. Pan Size and Profile: As indicated on Drawings.

G. Suspension System: Manufacturer's standard complying with requirements in ASTM C635/C635M; recommended in writing by ceiling and suspension-system manufacturers for applications indicated; complete with carriers, splice sections, stabilizing components, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.

1. Grid Suspension System: ASTM C635/C635M; recommended in writing by ceiling and suspension-system manufacturers for applications indicated; main- and cross-runner system complete with suspension-system components required to support ceiling units and other ceiling-supported construction.

a. Material: ASTM A653/A653M, hot-dip galvanized, cold-rolled sheet steel, G30 (Z90) coating designation with ASTM B209 (ASTM B209M) aluminum cap.
b. Structural Classification: Heavy-duty system.
c. Face Width: 15/16 inch (24 mm).
d. Finish: Flat black.

2.6 LINEAR METAL CEILINGS, INTERIOR

A. Linear Metal Pan Ceiling, Interior:

1. Basis of Design Manufacturer and Product:

a. Armstrong World Industries; Metalworks
b. Panel Selection and Finish: As scheduled or indicated in Design Selections.
c. NRC: Unless scheduled or indicated otherwise, not less than 0.70 when tested in accordance with ASTM C423.

B. Linear Metal Beam/Baffle Ceiling, Interior:

1. Basis of Design Manufacturer and Product:

a. Armstrong World Industries; Metalworks
b. Panel Selection and Finish: As scheduled or indicated in Design Selections.
c. NRC: Unless scheduled or indicated otherwise, not less than 0.70 when tested in accordance with ASTM C423

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 450 or less.

D. Pan Fabrication: Manufacturer's standard, size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.

E. Pan Size and Profile: As indicated on Drawings.

F. Pan Splices: Manufacturer's standard formed for snap fit into butt-cut pans.

1. Finish: Matching pan unless indicated otherwise.

G. End Caps: Manufacturer's standard material fabricated to fit and conceal exposed ends of pans.

1. Finish: Manufacturer's standard matching pan.

H. Filler Strips: Manufacturer's standard, fabricated to close voids between pans.

1. Finish: Matching pan unless indicated otherwise.

I. Suspension System: Manufacturer's standard complying with requirements in ASTM C635/C635M; recommended in writing by ceiling and suspension-system manufacturers for applications indicated; complete with carriers, splice sections, stabilizing components, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.

1. Grid Suspension System: ASTM C635/C635M; recommended in writing by ceiling and suspension-system manufacturers for applications indicated; main- and cross-runner system complete with suspension-system components required to support ceiling units and other ceiling-supported construction.

a. Material: ASTM A653/A653M, hot-dip galvanized, cold-rolled sheet steel, G30 (Z90) coating designation with ASTM B209 (ASTM B209M) aluminum cap.
b. Structural Classification: Heavy-duty system.
c. Face Width: 15/16 inch (24 mm).
d. Finish: Flat black.

2.7 LINEAR METAL CEILINGS, EXTERIOR

A. Linear Metal Pan Ceiling, Exterior:

1. Basis of Design Manufacturer and Product:

a. Armstrong World Industries; Metalworks Exterior.
b. Panel Selection and Finish: As scheduled or indicated in Design Selections.

B. Linear Metal Beam/Baffle Ceiling, Exterior:

1. Basis of Design Manufacturer and Product:

a. Armstrong World Industries; Metalworks Exterior.
b. Panel Selection and Finish: As scheduled or indicated in Design Selections.

C. Pan Fabrication: Manufacturer's standard, size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.

D. Pan Size and Profile: As indicated on Drawings.

E. Pan Splices: Manufacturer's standard formed for snap fit into butt-cut pans.

1. Finish: Matching pan unless indicated otherwise.

F. End Caps: Manufacturer's standard material fabricated to fit and conceal exposed ends of pans.

1. Finish: Manufacturer's standard matching pan.

G. Filler Strips: Manufacturer's standard, fabricated to close voids between pans.

1. Finish: Matching pan unless indicated otherwise.

H. Suspension System: Manufacturer's standard complying with requirements in ASTM C635/C635M; recommended in writing by ceiling and suspension-system manufacturers for applications indicated; complete with carriers, splice sections, stabilizing components, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.

1. Grid Suspension System: ASTM C635/C635M; recommended in writing by ceiling and suspension-system manufacturers for applications indicated; main- and cross-runner system complete with suspension-system components required to support ceiling units and other ceiling-supported construction.

a. Material: ASTM A653/A653M, hot-dip galvanized, cold-rolled sheet steel, G90 (Z275) coating designation with ASTM B209 (ASTM B209M) aluminum cap.
b. Structural Classification: Heavy-duty system.
c. Face Width: 15/16 inch (24 mm).
d. Finish: Flat black.

2.8 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C635/C635M requirements.

B. Suspension Systems: Provide systems recommended in writing by ceiling and suspension-system manufacturers for applications indicated; complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.

C. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.

D. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency. Confirm proposed expansion anchors are acceptable to SEOR for use on this Project.

E. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency. Confirm proposed power actuated fasteners are acceptable to SEOR for use on this Project.

F. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C635/C635M, Table 1, Direct Hung, is less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

G. Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

H. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

I. Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

J. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

K. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure metal pans in place.

L. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure metal pans in place.

M. Exterior Bracing: Cold-rolled steel channels and angles, hot-dip galvanized to comply with ASTM A653/A653M, G60 (Z180) coating designation; size and profile as required to withstand wind load.

N. Exposed Metal Edge Moldings and Trim: Provide exposed members as indicated or as required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching metal pan ceiling units unless otherwise indicated.

1. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.

O. Access Panels: For access at locations indicated, provide snap-in metal pan ceiling units, accessible by key or tool.

1. Access Key or Tool: Provide manufacturer's standard key or tool for opening access panels.

2.9 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. High-Humidity Finish, Exterior Exposures: Comply with ASTM C635/C635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

D. Finish Selections: As scheduled or as indicated in Design Selections.

2.10 ALUMINUM FINISHES

A. Fluoropolymer Finish, Exterior: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish, AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish, AAMA 2605 and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

B. Baked Enamel Finish or Powder-Coat Finish, Interior: Baked enamel or powder coated finish, AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

C. Clear Anodic Finish, Exterior: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

D. Clear Anodic Finish, Interior: AA-M12C22A31, Class II, 0.010 mm or thicker.

2.11 STEEL SHEET FINISHES

A. Fluoropolymer Finish, Exterior: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Provide dry film thickness, primers, color coats and clear coats required to comply with performance requirements and warranty periods indicated.

1. PVDF Fluoropolymer Finish: Fluoropolymer finish, AAMA 2605-compliant performance and containing not less than 70 percent PVDF resin by weight in color coat.
2. FEVE Fluoropolymer Finish: Fluoropolymer finish, AAMA 2605-compliant performance and containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat.

B. Baked Enamel Finish or Powder-Coat Finish, Interior: Baked enamel or powder coated finish, AAMA 2603-compliant performance. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.12 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Directional Satin Finish: No. 4.

D. Reflective, Directional Polish: No. 7.

E. Mirrorlike Reflective, Nondirectional Polish: No. 8.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Measure each ceiling area and establish layout of metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and coordination drawings.

3.4 INSTALLATION OF METAL PAN CEILINGS

A. Installation Quality Standard: Comply with the following standards, seismic design requirements and manufacturer's written instructions.

1. ASTM C 636 / C 636M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
2. ASCE/SEI 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
3. ASTM E 580 / E 580M, Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required[ ] to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members or carrying channels and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of ceiling area and where necessary to conceal edges of metal pans.

1. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Cut metal pan units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet. Cut and treat edges to comply with manufacturer's written instructions.

1. Provide factory edges for panels with exposed edges; field-cut edges may be used in locations concealed by moldings or edge caps providing factory-like appearance.

G. Install metal pans in coordination with suspension system and exposed moldings and trim. Comply with manufacturer's installation tolerances.

1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
2. Fit adjoining units to form flush, tight joints.
3. Install directionally patterned or textured metal pans in directions indicated.

H. Install sound attenuation panels in areas indicated by reflected ceiling plans or room finish schedules. Lay panels directly on ceiling system and close major openings to form complete coverage in required areas. Lay second sound-absorbent pads on sound attenuation panels.

3.5 FIELD QUALITY CONTROL

A. Manufacturer Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostic

B. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Suspended ceiling system.
2. Hangers, anchors, and fasteners.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.6 CLEANING

A. Clean exposed surfaces of metal pan ceilings, including trim and edge moldings, after removing strippable, temporary protective covering, if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 095426
SUSPENDED WOOD CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Suspended wood ceilings, metal suspension systems, and supplementary items necessary for installation.

1. Wood, linear-panel ceilings, interior.
2. Wood, linear-plank ceilings, exterior.
3. Wood, grille-panel ceilings, interior.

1.2 DELEGATED ENGINEERING REQUIREMENTS FOR CEILING ASSEMBLIES WITHSTANDING SEISMIC LOADS OR WIND LOADS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

B. Shop Drawings: For suspended wood ceilings.

1. Include reflected ceiling plans, sections, and details drawn to scale, showing the following items and coordinated with each other, using input from installers of the items involved:
    a. Ceiling patterns and joints.
    b. Suspension-system components.
    c. Method of attaching hangers to building structure and locations of cast-in-place anchors, clips, and other ceiling attachment devices.
    d. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
    e. Size and location of initial access modules.
    f. Ceiling-mounted items including, but not limited to, light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
    g. Ceiling perimeter and penetrations through ceiling; trim and moldings.

C. Samples for Verification: For the following products:
1. Wood Ceilings: 12-inch- (305-mm-) long by 12-inch- (305-mm-) wide or full-width Samples of each type, color, and finish.
2. Suspension-System Members: 12-inch- (305-mm-) long Sample of each type.
3. Exposed Molding and Trim: 12-inch- (305-mm-) long Samples of each type, color, and finish.
4. Veneer Edge Banding: Applied to a cut end of a wood-ceiling Sample for each type, color, and finish.
5. Filler Strips: 12-inch- (305-mm-) long Samples of each type, color, and finish.
6. Sound Absorbers: 12 inches (305 mm) long by full width.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its products and systems are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

D. Evaluation Reports: For wood-ceiling suspension systems.

E. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Materials: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Suspended-Wood-Ceiling Components: Quantity of each wood-ceiling unit, suspension-system component, accessory, and exposed molding and trim equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.8 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver ceiling components and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

1. Store materials flat and level, raised from the floor.

B. Handle ceiling components and accessories in a manner that prevents damage.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install interior ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

1. Store and acclimatize wood products in the spaces where they will be installed for a minimum of 72 hours immediately before ceiling installation.

1.11 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering product may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Armstrong World Industries, Inc.
2. Hunter Douglas Architectural Products, Inc.
3. Rulon International.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS FOR CEILING ASSEMBLIES WITHSTANDING SEISMIC LOADS OR WIND LOADS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Wind Loads: As indicated on Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

C. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined in accordance with the building code and authorities having jurisdiction.

1. ASCE/SEI 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
2. ASTM E 580 / E 580M, Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

D. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
2. Thermal Cycling: No buckling, damaging stresses, damaging loads on fasteners, and other detrimental effects.

2.4 WOOD, LINEAR-PANEL CEILINGS, INTERIOR

A. Wood-Veneer, Linear-Panel Ceilings, Interior: Linear panels fabricated from planks consisting of wood veneer adhered to backs and exposed surfaces of manufacturer's standard composite-wood cores. Planks run parallel to panel length.

1. Basis of Design Manufacturer and Product:

   a. Armstrong World Industries; Woodworks Linear Veneered Panels.

2. Surface-Burning Characteristics: Provide products with the following characteristics when tested in accordance with ASTM E84:

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

3. Plank:

   a. Manufacturer's standard unless scheduled or indicated otherwise in Design Selections.
   b. Adhesive: Manufacturer's standard that complies with Performance Requirements Article.
   c. Species and Cut: As scheduled or indicated in Design Selections.
   d. Dimensions, Spacing and Profile: As indicated on Drawings.
   e. Reveal Spacing: Reveal: As indicated on Drawings between long edges of planks.
   f. Backing Boards: Manufacturer's standard.

      1) Backing Board Gloss and Color: Flat black.

4. Panel Module: As indicated on Drawings.

   a. Attachment: Provide manufacturer's standard attachment hooks or clips for attaching panels to grid suspension system, spaced to support ceiling loads and in accordance with manufacturer's written installation instruction.

5. Factory Finish: Manufacturer's standard finish as scheduled or indicated in Design Selections; applied on every wood surface.
6. Accessories: Manufacturer's accessories required to provide a complete installation of ceiling in accordance with manufacturer's written installation instructions.

   a. Safety Cables: 24 inches (610 mm).
   b. Panel Splice Plates: Manufacturer's standard.
   c. Acoustic Infill Panels: Manufacturer's standard to provide NRC rating indicated, with flame-spread index of 25 or less and smoke-developed index of 450 or less as determined by testing in accordance with ASTM E84.

      1) NRC: Unless scheduled or indicated otherwise, not less than 0.70 when tested in accordance with ASTM C423.

   d. Acoustic Felt: Manufacturer's standard, factory applied, black, backer with flame-spread index of 25 or less and smoke-developed index of 450 or less as determined by testing in accordance with ASTM E84.
   e. End Caps: Manufacturer's standard units for exposed field-cut edges; solid wood finished to match planks.
   f. Trim: As indicated on Drawings>; with trim connectors recommended in writing by ceiling and suspension-system manufacturers.

      1) Material: Solid wood finished to match planks with trim connectors recommended by manufacturer.

7. Suspension System: Manufacturer's standard complying with requirements in ASTM C635/C635M; recommended in writing by ceiling and suspension-system manufacturers for applications indicated; complete with carriers, splice sections, stabilizing components, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.
    a. Material: ASTM A653/A653M, hot-dip galvanized, cold-rolled sheet steel, G30 (Z90) coating designation.
    b. Structural Classification: Heavy-duty system.
    c. Face Width: 15/16 inch (24 mm).
    d. Finish: Flat black.

2.5 WOOD, LINEAR-PLANK CEILINGS, EXTERIOR

A. Solid-Wood, Linear-Plank Ceilings, Exterior: Kiln-dried, solid-wood planks free of knots; without finger joints, cracks, checks, or warp, and with square-cut ends.

1. Basis of Design Manufacturer and Product:
    a. Armstrong World Industries; Woodworks Linear Solid Wood Panels.
2. Plank:
    a. Species and Cut: As scheduled or indicated in Design Selections.
    b. Dimensions, Spacing and Profile: As indicated on Drawings.
        1) Reveal: As indicated on Drawings between long edges of planks.
        2) Reveal Filler Strip: Black PVC.
    c. End Joints: Doweled.
3. Factory Finish: Manufacturer's standard finish as scheduled or indicated in Design Selections; applied on every wood surface.
4. Accessories: Linear-ceiling-plank manufacturer's accessories required to provide a complete installation of ceiling in accordance with manufacturer's written installation instructions.
    a. Attachment Clips: Manufacturer's standard metal clips for attaching planks to grid suspension system.
    b. Trim: As indicated on Drawings; in wood species and finished to match panels; with trim connectors recommended in writing by ceiling and suspension-system manufacturers.
5. Suspension System: Manufacturer's standard complying with requirements in ASTM C635/C635M; recommended in writing by ceiling and suspension-system manufacturers for applications indicated; complete with carriers, splice sections, stabilizing components, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.
    a. Material: ASTM A653/A653M, hot-dip galvanized, cold-rolled sheet steel, G90 (Z275) coating designation with ASTM B209 (ASTM B209M) aluminum cap.
    b. Structural Classification: Heavy-duty system.
    c. Face Width: 15/16 inch (24 mm).
    d. Finish: Flat black.

2.6 WOOD, GRILLE-PANEL CEILINGS, INTERIOR

A. Wood-Veneer, Grille-Panel Ceilings, Interior: Grille panels fabricated from rails consisting of wood veneer adhered to backs and exposed surfaces of manufacturer's standard composite-wood cores.

1. Basis of Design Manufacturer and Product:

a. Armstrong World Industries; Woodworks Grille.

2. Surface-Burning Characteristics: Provide products with the following characteristics when tested in accordance with ASTM E84:

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

3. Rails:

a. Face Grade: Manufacturer's standard unless scheduled or indicated otherwise in Design Selections.
b. Adhesive: Manufacturer's standard that complies with Performance Requirements Article.
c. Species and Cut: As scheduled or indicated in Design Selections.
d. Dimensions, Spacing and Profile: As indicated on Drawings.
e. Stabilizing Backer Strips: Manufacturer's standard type that attach rails together; spacing as recommended by manufacturer.

1) Material and Finish: Material and finish matching rails unless indicated otherwise; with finish applied to every surface.

f. Dowels: Manufacturer's standard dowels that attach rails together; spacing as recommended by manufacturer.

1) Material and Finish: Solid wood of same species and with same finish as rails unless indicated otherwise.

4. Panel Module: As indicated on Drawings.

a. Type: Clip-attached or Screw-attached installation on grid suspension system as recommended by manufacturer.

1) Attachment Clips: Panel manufacturer's standard black, corrosion-resistant, metal spring clips that allow downward access of panels.
2) Attachment Screws: Manufacturer's standard.

5. Factory Finish: Manufacturer's standard finish as scheduled or indicated in Design Selections; applied on every wood surface.
6. Accessories: Wood-grille-panel manufacturer's accessories required to provide a complete installation of ceiling in accordance with manufacturer's written installation instructions.

a. Acoustic Infill Panels: Manufacturer's standard to provide NRC rating indicated, with flame-spread index of 25 or less and smoke-developed index of 450 or less as determined by testing in accordance with ASTM E84.

1) NRC: Unless scheduled or indicated otherwise, minimum 0.70when tested in accordance with ASTM C423.

b. Acoustic Felt: Manufacturer's standard, factory applied, black, backer with flame-spread index of 25 or less and smoke-developed index of 450 or less as determined by testing in accordance with ASTM E84.

c. Veneer Edge Banding: Manufacturer's standard matching planks for treating cut edges; with pressure-sensitive adhesive backing.
d. Trim: As indicated on Drawings; with trim connectors recommended in writing by ceiling and suspension-system manufacturers.

1) Material: Wood-veneer-wrapped or solid wood finished to match rails with trim connectors recommended by manufacturer.

7. Suspension System: Manufacturer's standard complying with requirements in ASTM C635/C635M; recommended in writing by ceiling and suspension-system manufacturers for applications indicated; complete with carriers, splice sections, stabilizing components, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.

a. Material: ASTM A653/A653M, hot-dip galvanized, cold-rolled sheet steel, G30 (Z90) coating designation.
b. Structural Classification: Heavy-duty system.
c. Width: 15/16 inch (24 mm).
d. Finish: Flat black.

2.7 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C635/C635M requirements.

B. Suspension Systems: Provide systems recommended in writing by ceiling and suspension-system manufacturers for applications indicated; complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.

C. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.

D. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency. Confirm proposed expansion anchors are acceptable to SEOR for use on this Project.

E. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency. Confirm proposed power actuated fasteners are acceptable to SEOR for use on this Project.

F. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C635/C635M, Table 1, Direct Hung is less than yield stress of wire, but provide not less than 0.106-inch- (2.7-mm-)> diameter wire.

G. Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

H. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed from 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

I. Stabilizer Bars: Grid-suspension-system manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

J. Seismic Struts: Suspension-system manufacturer's standard compression struts designed to accommodate seismic forces.

K. Exterior Bracing: Cold-rolled steel channels and angles, hot-dip galvanized to comply with ASTM A653/A653M, G60 (Z180) coating designation; size and profile as required to withstand wind load.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Measure each ceiling area and establish layout of suspended wood ceilings.

1. Balance border widths at opposite edges of each ceiling.
2. Avoid using less-than-half-width units.

3.4 INSTALLATION OF WOOD CEILINGS

A. Installation Quality Standard: Comply with the following standards, seismic design requirements and manufacturer's written instructions.

1. ASTM C 636 / C 636M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
2. ASCE/SEI 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
3. ASTM E 580 / E 580M, Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, power-actuated fasteners, or postinstalled mechanical or adhesive anchors that extend through forms into concrete.
5. Do not attach hangers to steel deck tabs.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Space hangers not more than 48 inches (1219 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (203 mm) from ends of each member.
8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns in 1-1/2 inches (38 mm). Suspend bracing from building's structural members as required for hangers and without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim at perimeter of ceiling area and where necessary to conceal edges and ends of wood units.

1. Screw-attach metal moldings to substrate at intervals of not more than 16 inches (406 mm) o.c. and not more than 3 inches (76 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 ft. (3 mm in 3.7 m). Miter corners accurately and connect securely.
2. Do not use exposed fasteners on moldings and trim.

E. Grid Suspension Systems: Space main beams at 48 inches (1219 mm) o.c.

1. Install cross tees to form modules sized in accordance with manufacturer's written installation instructions .
2. Remove and replace dented, bent, or kinked members.

F. Linear-Carrier Suspension Systems: Install carriers at no more than 24 inches (610 mm o.c. aligned and securely interlocked with one another in accordance with manufacturer's written installation instructions.

1. Install stabilizer channels, tees, and bars at regular intervals to stabilize carriers and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated.
2. Remove and replace dented, bent, or kinked members.

G. Install wood components and accessories in accordance with manufacturer's written instructions and to accommodate natural expansion and contraction of wood products resulting from fluctuations in humidity.

H. Cut wood components for accurate fit at borders and at interruptions and penetrations by other work through ceilings.

1. Stiffen edges of cut wood components as required to eliminate variations in flatness.

I. Treat field-cut edges of wood components in accordance with manufacturer's written recommendations; finish exposed field cuts to match factory finish.

1. Solid-Wood Planks: Use solid-wood end caps to conceal exposed field-cut edges.
2. Wood-Veneer Units: Edge band exposed field-cut edges.

J. Install wood components in coordination with suspension system and moldings and trim.

1. Install wood components in patterns indicated on Drawings.

K. Install field-constructed access panels in locations indicated on Drawings.

3.5 FIELD QUALITY CONTROL

A. Manufacturer Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostic

B. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Suspended ceiling system.
2. Hangers, anchors, and fasteners.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.6 CLEANING

A. Clean exposed surfaces of ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented units.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 096500
RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resilient flooring products and systems and supplementary items necessary for installation.

1. Resilient tile flooring.
2. Resilient sheet flooring.
3. Luxury vinyl tile flooring.

B. Related Section:

1. Resilient wall base, reducer strips, and other accessories installed with resilient flooring are specified in Division 09 Section "Resilient Base and Accessories".

1.2 ALLOWANCES

A. Concrete Moisture Barrier Allowance: Include allowance to provide Concrete Moisture Barrier Floor Treatment to concrete floor decks.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, recommended adhesives, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings for Special Patterns: Show layout and details of special patterns for resilient flooring.

C. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

D. Samples for Verification Purposes: In manufacturer's standard size, but not less than 6 in by 9 in (150 mm by 230 mm) sample of each different color and pattern of resilient flooring product specified, showing the full range of variations expected in these characteristics. Label each sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in Schedules.

1. Heat-Welded Sheet Flooring: For heat-welding bead, manufacturer's standard-size samples, but not less than 9 in (225 mm) long, of each color specified.
2. Seam Samples for Sheet Flooring: For each color and pattern of resilient sheet flooring product required; with seam running lengthwise and in center of 6 in by 9 in (150 mm by 230 mm) sample applied to a rigid backing and prepared by installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

1. Product Compatibility: On installations incorporating products provided by more than one manufacturer, each manufacturer's certificate shall include specific reference to and approval of the other manufacturer's products.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Include in operation and maintenance manual as required by Division 01 Section "Closeout Procedures". Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Slip Resistance: Provide products identical to those tested for slip resistance per ASTM D 2047 with a static coefficient of friction not less than 0.6 for level surfaces and 0.8 for ramped surfaces.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. LVT manufacturer's qualified technical representative for each product specified
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store flooring products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C).

1. Resilient Tile Flooring: Store floor tiles on flat surfaces.
2. Resilient Sheet Flooring: Store sheet flooring rolls upright.

1.9 PROJECT CONDITIONS

A. Unless otherwise approved in writing by the manufacturer, do not begin flooring installation unless permanent building HVAC system is operational and capable of maintaining relative humidity and temperature of not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C) for at least 48 hours before installation, during installation, and after installation.

1. Maintain relative humidity of not more than the designed relative humidity for spaces to receive flooring.

B. Maintain flooring products prior to installation at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during flooring installation and for time period after installation recommended by manufacturer.

D. Install flooring products after other finishing operations, including painting, have been completed.

E. Do not install flooring over concrete substrates until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended tests. Refer to "Preparation" Article for requirements.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY FOR LUXURY VINYL TILE

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

1. Guestrooms Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 20 years from date of Substantial Completion.
2. Public Areas Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.

B. Installers Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installers standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit

as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Vinyl Flooring:

a. Altro Group.
b. Armstrong World Industries, Inc.
c. Congoleum Corporation.
d. Forbo Flooring, Inc.
e. Gerflor, Architectural Floor Systems, Inc.
f. Lonseal, Inc.
g. Mannington Mills, Inc.
h. Tarkett, Inc.

2. Rubber Flooring

a. AB; American Biltrite.
b. Flexco.
c. Nora Systems, inc.
d. PRF USA, Inc.
e. R.C.A. Rubber Company (The).
f. VPI, LLC, Floor Products Division.

3. Linoleum Flooring:

a. Armstrong World Industries, Inc.
b. Forbo Industries, Inc.
c. Johnsonite; A Tarkett Company.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 RESILIENT TILE FLOORING MATERIALS

A. Vinyl Composition Floor Tile Standard: ASTM F 1066, Class 2, through-pattern tile, unless otherwise indicated.

1. Size: 12 in by 12 in by 0.125 in (300 mm by 300 mm by 3 mm).

B. Solid Vinyl Floor Tile Standard: ASTM F 1700, Class 1, monolithic vinyl tile, unless otherwise indicated.

1. Size: 12 in by 12 in by 0.125 in (300 mm by 300 mm by 3 mm).

C. Linoleum Floor Tile Standard: ASTM F 2195, Type I, linoleum floor tile with fibrous backing, unless otherwise indicated.

1. Size: 12 in by 12 in by 0.125 in (300 mm by 300 mm by 3 mm).

D. Rubber Floor Tile: ASTM F 1344, Class I, unless otherwise indicated.

1. Size: 12 in by 12 in by 0.125 in (300 mm by 300 mm by 3 mm).

2.4 RESILIENT SHEET FLOORING MATERIALS

A. Vinyl Sheet Floor Coverings: ASTM F 1303, Type I or II, Grade 1, Class A (fibrous) or B (nonfoamed plastic) backing or ASTM F 1913 unbacked as required by product selection.

B. Rubber Sheet Floor Coverings: ASTM F 1859, Type I (homogeneous rubber sheet).

C. Sheet Linoleum Floor Coverings: Consisting of oxidized linseed or other vegetable drying oil and rosin, mixed with ground cork or wood flour, mineral filler, and pigments. Mixture is bonded and keyed to burlap (jute) or other suitable fibrous backing to that backing is partially embedded in mixture. Patterns and colors extend through entire floor covering thickness.

D. Sheet Flooring Thickness: 0.125 in (3 mm).

E. Heat-Welding Seam Bead: Solid-strand product of floor covering manufacturer for heat welding seams.

1. Selections: As scheduled or as indicated in Design Selections.

F. Chemical Seam Bonding Compound: Formulation provided or approved by flooring manufacturer for chemically bonding seams.

G. Integral Cove Base Accessories: Resilient accessories recommended by flooring manufacturer with selections as follows:

1. Basis of Design: Burke Mercer Flooring Products; Division of Burke Industries, Inc.

a. Cap Strip: No. 040 round vinyl cap.
b. Cove Strip: No. 070 flexible vinyl cove stick with nominal 1 in (25 mm) radius.
c. Reducer: No. 633 vinyl reducer, 1 in (25 mm) wide by 1/8 in (3 mm) high.

2.5 LUXURY VINYL TILE FLOORING MATERIALS

A. LVT Class: ASTM F1700 Composition of Material: Class III Printed Film Vinyl Plank or Tile, Type B (Embossed).

1. Size and Squareness: ASTM F 2055, plus or minus 0.016-inch per linear foot in size and less than 0.010-inch for squareness.
2. Overall Thickness: 0.1875-inch (4 mm and thicker).

a. Wear Layer Thickness: ASTM F386, plus or minus 0.020-inch (0.5 mm).

3. Backing Class: Commercial Grade.
4. Dimensional Stability: ASTM F2199, less than 0.020-inch per linear foot.
5. Residual Indentation: ASTM 1914, less than 8 percent total thickness.
6. Flexibility: ASTM F137, less than 1.0-inch diameter, no cracks or breaks.
7. Chemical Resistance: ASTM F 925, no more than slight change in surface dulling, attack or color change.
8. Heat resistance: ASTM F1514, less than 8 color change.
9. Light Resistance: ASTM F1515, less than 8 color change.
10. Static Load Limit: ASTM F 970, 750 psi minimum.

2.6 SOUND REDUCTION SHEET MEMBRANE UNDERLAYMENTS FOR LUXURY VINYL TILE

A. General: Manufacturer's standard product complying with Floor Assembly Sound Reduction Performance Requirements. Include primer, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products as required by underlayment manufacturer and recommended by the flooring manufacturer for this application.

1. Sound reduction underlayment may be a separate component as recommended by the LVT flooring manufacturer and compatible with the LVT flooring material or the underlayment may be a composite component integral to the LVT flooring material.

B. Floor Assembly Sound Reduction Requirements: Sound reduction membrane underlayments shall contribute to achieving following ratings in floor assemblies when tested by qualified independent testing agency acceptable to authorities having jurisdiction.

1. In addition to laboratory test, the installation shall be field tested to determine the acoustic performance:

a. Sound Transmission Class (STC): Not less than 60 according to ASTM E 90.
b. Laboratory Impact Insulation or Isolation Class (IIC): Not less than 57 according to ASTM E 492.
c. Field Impact Insulation or Isolation Class (AIIC): Not less than 53 according to ASTM E 1007, Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures.
d. Sound reduction underlayment may be a separate component as recommended by the LVT flooring manufacturer and compatible with the LVT flooring material or the underlayment may be a composite component integral to the LVT flooring material

2.7 ACCESSORY MATERIALS

A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

B. Trowelable Leveling and Patching Compounds: Latex-modified, Portland-cement-based formulation provided or approved by flooring manufacturer for products and applications indicated.

C. Cementitious Backer Unit at Access Flooring Panel Substrate: ANSI A118.9 or ASTM C 1325; cementitious panels composed of Portland cement, aggregates, glass mesh on both faces, and manufacturer proprietary ingredients; capable of remaining unaffected by prolonged exposure to water; 1/4 in (6 mm) thick.

D. Adhesives: Water-resistant type recommended by flooring manufacturer suitable for products, applications, and substrate conditions indicated.

1. Product Compatibility: Provide Manufacturer's written recommendation for each product within an assembly. On installations incorporating products provided by more than one manufacturer, each manufacturer shall approve in writing all adhesives that are in contact with their products.

E. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

F. Concrete Moisture Barrier Floor Treatment:

1. Epoxy-Based Moisture Barrier Floor Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, two-component, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete,

prior to installation of impervious glued-down finish flooring specified in other Division 09 sections.

a. Basis of Design (Product Standard): Bostik, Inc.; D-250.

2. Cementitious Overcoat: Fast-setting latex-fortified Portland cement skim coating intended for interior uses.

a. Basis of Design (Product Standard): Bostik, Inc.; Webcrete 95.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that concrete substrate finishes comply with requirements specified in Division 03 Section "Concrete Finishing" for concrete substrates receiving resilient flooring.
2. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.
3. Verify that concrete substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Unless concrete has been water-cured, then proceed with the following:

a. Bead-blast concrete substrate with an apparatus that abrades the surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Repair damaged and deteriorated concrete according to flooring manufacturer's written recommendations.

4. Determine adhesion and dryness characteristics by performing the following tests as recommended by flooring manufacturer.
5. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. A pH range of 5 to 9 is required when substrate is wetted with distilled water and pHydrion paper is applied. Proceed with installation only after concrete substrates pass testing.

6. Moisture Testing: Perform one or both of the following tests as recommended by flooring manufacturer. Perform 3 moisture tests for first 1000 sf (92.9 sm) of concrete substrate scheduled to receive flooring and 1 test for each additional 1000 sf (92.9 sm) or fraction thereof. Proceed with installation only after concrete substrates pass testing.
   a. Perform anhydrous calcium chloride test in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sf (1.36 kg of water/92.9 sm) in 24 hours.
   b. Perform relative humidity test using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 75 percent relative humidity level measurement.
7. Moisture Barrier Floor Treatment: For concrete substrates not meeting moisture test standards specified above, apply epoxy-based moisture floor treatment and cementitious overcoat to concrete substrate in accordance with manufacturer's written instructions.

C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

D. Broom and vacuum clean substrates to be covered immediately before flooring product installation. After cleaning, reexamine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.4 INSTALLATION OF RESILIENT FLOORING, GENERAL

A. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings. Extend flooring to center of door openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on substrate. Use chalk or other nonpermanent, non-staining marking device.

E. Adhere flooring to substrates using a full spread of adhesive applied to substrate to comply with flooring manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
   1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

F. Hand-roll flooring in both directions from center out to embed flooring in adhesive and eliminate trapped air according to manufacturer's written instructions. At walls, door casings, and other locations where access by roller is impractical, press flooring firmly in place with flat-bladed instrument.

3.5 INSTALLATION OF RESILIENT TILE FLOORING

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles square with room axis, unless otherwise indicated.
2. Lay tiles with grain running in one direction, unless otherwise indicated.

C. Access Flooring Panel Substrate: Do not install tile over panel substrate seams.

D. Access Flooring Panel Substrate: Install cement board substrate over access flooring panel substrate before installation of resilient flooring.

3.6 INSTALLATION OF RESILIENT SHEET FLOORING

A. Unroll sheet flooring and allow it to stabilize before cutting and fitting, if recommended in writing by manufacturer.

B. Lay out sheet flooring to comply with the following requirements:

1. Maintain uniformity of sheet flooring direction.
2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6 in (150 mm) away from parallel joints in flooring substrates.
3. Match edges of sheet flooring for color shading and pattern at seams according to manufacturer's written recommendations.
4. Avoid cross seams.

C. Integral Cove Base: Form integral cove base by flashing sheet flooring up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt flooring at top of base against cap strip.

D. Heat-Welded Seams: Rout joints and heat weld with welding bead, permanently fusing sections into seamless flooring. Prepare, weld, and finish seams according to manufacturer's written instructions and ASTM F 1516 to produce surfaces flush with adjoining flooring surfaces.

E. Chemically Bonded Seams: Chemically bond seams with bonding compound, permanently fusing sections into seamless flooring. Prepare seams and apply compound according to manufacturer's written instructions and ASTM F 693 to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.

F. Access Flooring Panel Substrate: Install cement board substrate over access flooring panel substrate before installation of resilient flooring.

3.7 INSTALLATION OF LUXURY VINYL FLOORING, GENERAL

A. Apply concrete slab primer, if recommended by LVT flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

B. Scribe, cut, and fit flooring and underlayment to allow for thermal movement to gap to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings. Extend flooring to center of door openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on substrate. Use chalk or other nonpermanent, non-staining marking device.

E. Where floating installation is indicated or required, maintain a minimum 5/16 inch expansion around perimeter of the room.

F. Where adhered installation is indicated or required, adhere flooring components to substrates using a full spread of adhesive applied to substrate to comply with flooring manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

G. Hand-roll flooring in both directions from center out to embed flooring in adhesive and eliminate trapped air according to manufacturer's written instructions. At walls, door casings, and other locations where access by roller is impractical, press flooring firmly in place with flat-bladed instruments.

3.8 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing flooring products:

1. Remove adhesive and other surface blemishes from exposed surfaces using cleaner recommended by flooring manufacturer.
2. Sweep or vacuum floor thoroughly.
3. Do not wash floor until after time period recommended by flooring manufacturer.
4. Damp-mop floor to remove marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by flooring manufacturer.

1. Cover products installed on floor surfaces with undyed, untreated building paper until just prior to Substantial Completion.
2. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Floor Polish: Remove soil, visible adhesives, and surface blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply two coats.

3.9 RESILIENT FLOORING SCHEDULE

A. Vinyl Composition Tile:

1. VCT01:

a. Manufacturer:
b. Pattern:
c. Size:
d. Color Selection:

2. Selections: As selected by Architect from full range of industry colors.

B. Solid Vinyl Tile:

1. VT01:

a. Manufacturer:
b. Pattern:
c. Size:
d. Color Selection:

C. Rubber Floor Tile:

1. RT01:

    a. Manufacturer:
    b. Pattern:
    c. Size:
    d. Color Selection:

D. Linoleum Floor Tile:

1. LT01:

    a. Manufacturer:
    b. Pattern:
    c. Size:
    d. Color Selection:

E. Sheet Vinyl Flooring:

1. SHV01:

    a. Manufacturer:
    b. Product:
    c. Color Selection:
    d. Seam Treatment: Heat-weld.
    e. Seam Treatment: Chemical-bonded
    f. Base: Integral, 6 in (150 mm) high
    g. Base: Separate; refer to Division 09 Section "Resilient Base and Accessories."
    h. Welding Rod Color: As selected by Architect from full range of industry colors.
    i. Welding Rod Color: Match field color of sheet floor covering.
    j. Welding Rod Color:

F. Sheet Rubber Flooring:

1. SHR01:

    a. Manufacturer:
    b. Product:
    c. Color Selection:
    d. Seam Treatment: Heat-weld.
    e. Seam Treatment: Chemical-bonded
    f. Base: Integral, 6 in (150 mm) high
    g. Base: Separate; refer to Division 09 Section "Resilient Base and Accessories."
    h. Welding Rod Color: As selected by Architect from full range of industry colors.
    i. Welding Rod Color: Match field color of sheet floor covering.
    j. Welding Rod Color:

G. Sheet Linoleum Flooring:

1. SHL01:

    a. Manufacturer:
    b. Product:
    c. Color Selection:
    d. Seam Treatment: Heat-weld.
    e. Seam Treatment: Chemical-bonded
    f. Base: Integral, 6 in (150 mm) high
    g. Base: Separate; refer to Division 09 Section "Resilient Base and Accessories."
    h. Welding Rod Color: As selected by Architect from full range of industry colors.
    i. Welding Rod Color: Match field color of sheet floor covering.

j. Welding Rod Color:

H. Luxury Vinyl Tile:

1. LVT01:

a. Manufacturer: Shaw Contract; Hard Surface.
b. Pattern: Quitecover #1086V Wood Look Floating Vinyl Plank
c. Size: 7□ x 48□ Plank.
d. Color Selection: Cottonwood.
e. Acoustic Underlayment: Shaw Groundworks Acoustical Underlayment

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 096513
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resilient wall base, resilient flooring accessories, and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

C. Samples for Verification Purposes: In manufacturer's standard size, but not less than 12 in (300 mm) sample of each different color and pattern of resilient product specified, showing the full range of variations expected in these characteristics.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by product manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.7 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless otherwise recommended by product manufacturer.

B. Maintain resilient products prior to installation at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during installation and for time period after installation recommended by manufacturer.

D. Install resilient products after other finishing operations, including painting, have been completed.

E. Resilient Stair Accessories: Do not install resilient stair accessories over concrete substrates until slabs have cured and are sufficiently dry to bond with adhesive, as determined by resilient accessory manufacturer's recommended tests. Refer to "Examination" Article for requirements.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturer:

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
3. Endura Rubber Flooring; Division of Burke Industries, Inc.
4. Flexco, Inc.
5. Johnsonite.
6. Mondo Rubber International, Inc.
7. Musson, R. C. Rubber Co.
8. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
9. Roppe Corporation, USA.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 RESILIENT MATERIALS

A. Rubber Wall Base:

1. Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic), Group 1 and 2.

2. Thickness: Nominal 1/8 in (3 mm).
3. Lengths: Provide longest length(s) available per manufacturer. Provide coils if available in profile(s) indicated.
4. Outside and Inside Corners:
   a. Job-formed.
   b. Pre-formed.

B. Resilient Molding Accessories:

1. Carpeting Accessories: Carpet cove cap, carpet step-off, carpet reducer, carpet edge bar.
2. Resilient Flooring Accessories: Reducer strip and others as required.
3. Material: Rubber.
4. Lengths: Provide longest length(s) available per manufacturer. Provide coils if available in profile(s) indicated.
5. Color and finish as selected by Architect from manufacturer's standard colors.

C. Resilient Stair Accessories:

1. Standard: ASTM F 2169, Type TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic), Class 1 and 2.
2. Rubber Stair Treads:
   a. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
   b. Nosing Height: 1-1/2 in (38 mm) to 2 in (50 mm).
   c. Thickness: 1/4 in (6 mm) at nosing, tapered to 1/8 in (3 mm).
   d. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.
   e. Manufacturing Method: Group 1, tread with embedded abrasive strips; and Group 2, tread with contrasting color for the visually impaired; as selected by Architect.
   f. Exit Stairs at High Rise Structures: Provide embedded photoluminescent abrasive strips, minimum 1 inch (25 mm) wide by full width of stair nosing, incorporated into stair nosings.
3. Risers: Smooth, flat, coved-toe, 1/4 in (6 mm) thick by 7 in (175 mm) high by length matching treads produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
4. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

2.4 ACCESSORY MATERIALS

A. Adhesives: Water-resistant type recommended by product manufacturer suitable for products, applications, and substrate conditions indicated.

B. Resilient Stair Accessory Materials:

1. Concrete Slab Primer: Non-staining type as recommended by product manufacturer.
2. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based formulation provided or approved by product manufacturer for products and applications indicated.
3. Stair Tread-Nose Filler: Two-part epoxy compound recommended by rubber stair tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Concrete Substrates for Resilient Stair Accessories: Prepare according to ASTM F 710.

1. Verify that concrete substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing the following tests as recommended by resilient accessory manufacturer.
2. Verify that concrete substrate finishes comply with requirements specified in Division 03 Section "Concrete Finishing" for concrete substrates receiving resilient flooring.
3. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.
4. Alkalinity and Adhesion Testing: Perform tests recommended by resilient accessory manufacturer. A pH range of 5 to 9 is required when substrate is wetted with distilled water and pHydrion paper is applied. Proceed with installation only after concrete substrates pass testing.
5. Moisture Testing: Perform one or both of the following tests as recommended by resilient accessory manufacturer. Perform 3 moisture tests for first 1000 sf (92.9 sm) of concrete substrate scheduled to receive resilient stair accessories. Proceed with installation only after concrete substrates pass testing.

   a. Perform anhydrous calcium chloride test in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sf (1.36 kg of water/92.9 sm) in 24 hours.
   b. Perform relative humidity test using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 75 percent relative humidity level measurement.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Resilient Stair Accessories:

1. Remove substrate coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
3. Broom and vacuum clean substrates to be covered by resilient stair accessories immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.
4. Apply concrete slab primer, if recommended by product manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.4 INSTALLATION OF RESILIENT WALL BASE

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. Masonry Wall Surfaces: On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Job-Formed Corners: Use straight pieces of maximum lengths possible.

1. Outside Corners: Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

G. Pre-formed Corners: Install pre-formed corners before installing straight pieces.

3.5 INSTALLATION OF RESILIENT FLOORING ACCESSORIES

A. Resilient Stair Accessories:

1. Use stair tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.6 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes from exposed surfaces using cleaner recommended by manufacturer.
2. Sweep or vacuum horizontal surfaces thoroughly.
3. Do not wash resilient products until after time period recommended by manufacturer.
4. Damp-mop surfaces to remove marks and soil.

B. Protect resilient products against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.

3.7 RESILIENT PRODUCT SCHEDULE

A. Resilient Wall Base:

1. RB01:

a. Manufacturer:
b. Height: 2-1/2 in (62 mm)
c. Height: 4 in (100 mm)
d. Height: 6 in (150 mm)
e. Type: Straight at carpet; coved elsewhere.
f. Type: Coved.
g. Color Selection: As selected by Architect from full range of industry colors.
h. Color Selection:

B. Resilient Stair Accessories:

1. Manufacturer:
2. Style:
3. Color Selection:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 096603
PRECAST TERRAZZO FLOORING AT STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Precast terrazzo flooring products and systems for use at stairs along with supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work.

C. Samples for Verification Purposes: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify matrix color and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the Work in size indicated below:

1. Precast Terrazzo: 6 in (150 mm) square samples.
2. Accessories: 6 in (150 mm) long samples of each exposed accessory item.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals. Submit manufacturer’s instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance. Include product data for flooring care products used or recommended by installer and names, addresses, and telephone numbers of local sources for products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. NTMA Membership: Installer shall be a contractor member of NTMA.

B. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
    a. Show typical components, attachments to building structure, and requirements of installation.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
    a. Architect.
    b. Contractor, including superintendent.
    c. Installer, including project manager and supervisor.
    d. If requested, Manufacturer's qualified technical representative.
    e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
    a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
    b. Review Contract Document requirements.
    c. Review approved submittals.
    d. Review inspection and testing requirements.
    e. Review environmental conditions and procedures for coping with unfavorable conditions.
    f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number, if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

B. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials

2.2 PRECAST CEMENTITIOUS TERRAZZO

A. Precast Terrazzo Base Units: Minimum 3/4 in (19 mm) thick, resinous or reinforced-cementitious terrazzo units cast in maximum lengths possible, but not less than 36 in (900 mm).

1. Type: Straight.
2. Top Edge (Exposed): Beveled with polished top surface.
3. Outside Corner Units: With finished returned edges at outside corner.
4. Color and Pattern: Match adjacent terrazzo flooring.
5. Height: As indicated on drawings.

B. Precast Terrazzo Units: Comply with NTMA's written recommendations for fabricating precast resinous terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer.

1. Color and Pattern: Asscheduled or as indicated in Design Selections.

C. Abrasive Nosings at Stair Treads and Landings: Abrasive nosing strip and two-line abrasive inserts at nosings and tops of landings.

D. Precast Terrazzo Finishing:

1. Finish exposed-to-view edges or reveals to match face finish.
2. Ease exposed edges to 1/8 in (3 mm) radius.

2.3 ACCESSORY MATERIALS

A. Abrasive Strips for Stair Treads and Landings: Silicon carbide or aluminum oxide in epoxy-resin binder set in channel, 1/2 in (12 mm) wide by depth required by terrazzo thickness by 4 in (100 mm) less than stair width. Color as selected by Architect from manufacturer's full range.

B. Anchoring Devices: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.

C. Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.

D. Terrazzo Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral with pH factor between 7 and 10, does not affect color or physical properties of terrazzo, is recommended by sealer manufacturer, and complies with NTMA Guide Specification for terrazzo type indicated.

E. Joint Sealants: As specified in Division 07 Section "Joint Sealants".

2.4 SETTING MORTAR AND GROUT MATERIALS

A. LHT Latex-Portland Cement Mortar:

1. Material Quality Standard: ANSI A118.4 and ANSI A118.15, with the following physical properties:

a. Manufacturer's premium polymer modified LHT mortar product; gray color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
c. Non-sag capability.
d. Suitable for use in LHT mortar beds up to 1/2 in (12 mm) thick.

2. Manufacturers and Products - Floor:

a. ARDEX Engineered Cements; X 77 Microtec.
b. Custom Building Products; ProLite Tile & Stone Mortar.
c. Laticrete International, Inc.; Laticrete Tri-Lite Large and Heavy Tile Mortar.
d. Mapei Corp.; Ultraflex LFT.
e. Sika Corp.; SikaTile 500 LHT Lite.
f. Sika Corp.; Merkrete 820 Dustless Merlite.
g. Schluter Systems; All-Set.

B. Thin-Set Latex-Portland Cement Mortar:

1. Material Quality Standard: ANSI A118.4 and ANSI A118.15, with the following physical properties:

a. Manufacturer's premium polymer modified thin-set product; gray color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
c. Non-sag capability.
d. Suitable for use in thin set mortar beds up to 1/4 in (6 mm) thick.

2. Manufacturers and Products - Floor:

a. ARDEX Engineered Cements; X 77 Microtec.
b. Custom Building Products; ProLite Tile & Stone Mortar.
c. Laticrete International, Inc.; Laticrete 254 Platinum Thin-Set Mortar.
d. Mapei Corp.; Keraflex Super Mortar.
e. Sika Corp.; SikaTile 500 LHT Lite.
f. Sika Corp.; Merkrete 820 Dustless Merlite.
g. Schluter Systems; All-Set.

3. Manufacturers and Products - Wall:

a. ARDEX Engineered Cements; X 77 Microtec.
b. Custom Building Products; ProLite Tile & Stone Mortar.
c. Laticrete International, Inc.; Laticrete Tri-Lite Large and Heavy Tile Mortar.
d. Mapei Corp.; Keraflex Super Mortar.
e. Sika Corp.; SikaTile 500 LHT Lite.
f. Sika Corp.; Merkrete 820 Dustless Merlite.
g. Schluter Systems; All-Set.

C. Latex-Portland Cement Grout for Joints:

1. Unsanded Grout:
   a. Material Quality Standard: ANSI A118.7, with following physical properties:
      1) Manufacturer's premium polymer modified unsanded grout product.
      2) Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
   b. Manufacturers and Products:
      1) ARDEX Engineered Cements; FG-C Unsanded Grout.
      2) Custom Building Products; Prism Surecolor Grout.
      3) Laticrete International, Inc.; Permacolor Grout.
      4) Laticrete International, Inc.; Permacolor Select NS.
      5) Mapei Corp.; Ultracolor Plus FA Grout.
   c. Locations: Joints less than 1/8 in (3 mm) wide.
2. Sanded Grout:
   a. Material Quality Standard: ANSI A118.7, with following physical properties:
      1) Manufacturer's premium polymer modified sanded grout product.
      2) Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
   b. Manufacturers and Products:
      1) ARDEX Engineered Cements; FL Rapid Set, Flexible, Sanded Grout.
      2) Custom Building Products; Prism Surecolor Grout.
      3) Laticrete International, Inc.; Permacolor Grout.
      4) Laticrete International, Inc.; Permacolor Select Grout.
      5) Mapei Corp.; Ultracolor Plus FA Grout.
   c. Locations: Joints 1/8 in (3 mm) wide and larger.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
   1. Respective manufacturer’s written installation instructions.
   2. Accepted submittals.
   3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

3.4 INSTALLATION OF PRECAST TERRAZZO

A. Install precast terrazzo units using method recommended by NTMA and manufacturer, unless otherwise indicated.

B. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8 in (3 mm) maximum in length, height, or width; noncumulative.

C. Do not install units that are chipped, cracked, discolored, or improperly finished.

D. Seal joints between units with joint sealant in accordance with Division 07 Section "Joint Sealants".

3.5 REPAIR

A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.6 CLEANING AND PROTECTING

A. Sealing:

1. Seal surfaces according to NTMA's written recommendations.
2. Apply sealer according to sealer manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure terrazzo is without damage or deterioration at time of Substantial Completion.

3.7 FINISH SCHEDULE

A. Color and Pattern: Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

B. Color and Pattern: As selected by Architect from NTMA standard-terrazzo plates.

C. Color and Pattern:

D. TER01:

1. Color and Pattern: NTMA Plate No. XX

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 096623
THIN-SET TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Thin-set epoxy-resin terrazzo flooring products and systems and supplementary items necessary for installation.

1.2 ALLOWANCES

A. Concrete Moisture Barrier Allowance: Include allowance to provide Concrete Moisture Barrier Floor Treatment to concrete floor decks.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Include the following:

1. Divider, control-, and expansion-joint strips.
2. Base and border strips.
3. Abrasive strips.
4. Stair treads, risers, and landings.
5. Precast terrazzo jointing and edge configurations.
6. Terrazzo patterns.

C. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

D. Samples for Verification Purposes: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify matrix color and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the Work in size indicated below:

1. Terrazzo: 12 in (300 mm) square samples.
2. Accessories: 6 in (150 mm) long samples of each exposed strip item required.
3. Precast Terrazzo: 6 in (150 mm) square samples.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals. Submit manufacturer’s instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance. Include product data for flooring care

products used or recommended by installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.
4. NTMA Membership: Installer shall be a contractor member of NTMA.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

   a. Architect.
   b. Contractor, including superintendent.
   c. Installer, including project manager and supervisor.
   d. If requested, Manufacturer's qualified technical representative.
   e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Contract Document requirements.

c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number, if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

B. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

C. Close spaces to traffic during epoxy terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

D. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

E. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Crossfield Products Corp., Dex-O-Tex Division; Cheminert Terrazzo.
2. EnviroGLAS Products, Inc.; EnviroTRAZ.
3. Key Resin Co.; Key Epoxy Terrazzo #108.
4. Sherwin-Williams; Resuflor Terrazzo TG.

5. Sika Corporation; SikaFloor Terrazzo Resin.
6. TEC Specialty Construction Brands, Inc.; Tuff-Lite Epoxy Terrazzo.
7. Terrazzo & Marble Supply Co.; Terroxy Resin System.

2.2 MATERIALS, GENERAL

A. Single Source Limitations for Aggregates: Obtain each color, grade, type, and variety of aggregate from one source with resources to provide materials of consistent quality in appearance and physical properties. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

C. Floor / Ceiling Assembly Sound Reduction Requirements: Sound isolation membranes shall contribute to achieving following ratings in floor / ceiling assemblies when tested by qualified independent testing agency acceptable to authorities having jurisdiction:

1. Impact Insulation (or Isolation) Class (IIC): Not less than 50 according to ASTM E 492 and ASTM E 989.

2.4 THIN-SET RESINOUS TERRAZZO MATERIALS

A. Flexible Reinforcing Membrane: Manufacturer's recommended resinous membrane for substrate crack preparation and reflective crack reduction.

B. Sound Isolation and Flexible Reinforcing Membrane: Manufacturer's recommended resinous membrane for sound reduction and for substrate crack preparation and reflective crack reduction.

C. Primer: Manufacturer's product recommended for substrate and use indicated.

D. Epoxy Resin: Manufacturer's standard recommended for use indicated and in color required for mix indicated.

1. Physical Properties without Aggregates:

a. Hardness: 60 to 85 per ASTM D 2240, Shore D.
b. Minimum Tensile Strength: 3000 psi (20.7 MPa) per ASTM D 638 for a 2 in (50 mm) specimen made using a "C" die per ASTM D 412.
c. Minimum Compressive Strength: 10,000 psi (6.9 MPa) per ASTM D 695, Specimen B cylinder.
d. Chemical Resistance: No deleterious effects by contaminants listed below after 7 day immersion at room temperature per ASTM D 1308.

1) Distilled water.
2) Mineral water.
3) Isopropanol.
4) Ethanol.
5) 0.025 percent detergent solution.
6) 1.0 percent soap solution.
7) 10 percent sodium hydroxide.

8) 10 percent hydrochloric acid.
9) 30 percent sulfuric acid.
10) 5 percent acetic acid.

2. Physical Properties with Aggregates: For resin blended with Georgia White marble, ground, grouted, and cured per requirements in NTMA's "Guide Specification for Epoxy Terrazzo," comply with the following:

a. Flammability: Self-extinguishing, maximum extent of burning 0.25 in (6.35 mm) per ASTM D 635.
b. Thermal Coefficient of Linear Expansion: 0.0025 in/in per deg F (0.0025 mm/mm per 0.5556 deg C) for temperature range of minus 12 to 140 deg F (minus 24 to plus 60 deg C) per ASTM D 696.

E. Aggregate: Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.

1. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
2. 24-Hour Absorption Rate: Less than 0.75 percent.
3. Dust Content: Less than 1.0 percent by weight.

F. Finishing Grout: Resin based.

G. Terrazzo Mix: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and marble-chip proportions and mixing.

1. Color and Pattern: As scheduled or as indicated in Design Selections.

2.5 STRIP MATERIALS

A. Heavy-Top Divider Strips: L-type angle, 3/8 in (10 mm) deep.

1. Bottom-Section Material: Match top section material.
2. Top-Section Material: White zinc alloy.
3. Top-Section Material: Half-hard brass.
4. Top-Section Material: As scheduled or as indicated in Design Selections.
5. Top-Section Width: 1/8 in (3 mm).
6. Top-Section Width: 1/4 in (6 mm).
7. Top-Section Width: 3/8 in (10 mm).
8. Top-Section Width: As scheduled or as indicated in Design Selections.

B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.

C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Base-bead strips for exposed top edge of terrazzo base.
2. Edge-bead strips for exposed edges of terrazzo.
3. Nosings for terrazzo stair treads and landings.

D. Abrasive Strips for Stair Treads and Landings: Silicon carbide or aluminum oxide in epoxy-resin binder set in channel, 1/2 in (12 mm) wide by depth required by terrazzo thickness by 4 in (100 mm) less than stair width. Color as selected by Architect from manufacturer's full range.

2.6 ACCESSORY MATERIALS

A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.

B. Anchoring Devices:

1. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.

C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

D. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.

E. Seal Coat: Slip- and stain-resistant surface-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.

F. Joint Sealants: As specified in Division 07 Section "Joint Sealants".

2.7 PRECAST EPOXY-RESIN TERRAZZO

A. Precast Terrazzo Base Units: Minimum 3/4 in (19 mm) thick, resinous terrazzo units cast in maximum lengths possible, but not less than 36 in (900 mm).

1. Type: Coved with minimum 3/4 in (19 mm) radius.
2. Type: Straight.
3. Type: As indicated on drawings.
4. Type: As scheduled or as indicated in Design Selections.
5. Top Edge (Concealed): Straight, unfinished.
6. Top Edge (Exposed): Beveled with polished top surface.
7. Top Edge (Exposed): Radius edge with polished top surface.
8. Top Edge (Exposed): As scheduled or as indicated in Design Selections.
9. Metal Toe Strip for Coved-Toe Bases: Match divider strips.
10. Outside Corner Units: With finished returned edges at outside corner.
11. Color and Pattern: Match adjacent terrazzo flooring.
12. Height: 4 in (100 mm).
13. Height: 6 in (150 mm).
14. Height: As indicated on drawings.
15. Height: As scheduled or as indicated in Design Selections.

B. Precast Terrazzo Units: Comply with NTMA's written recommendations for fabricating precast resinous terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer.

1. Color, Pattern, and Finish: Match adjacent terrazzo flooring.
2. Stair Treads and Landings: Abrasive nosing strip and two-line abrasive inserts at nosings and tops of landings.

C. Precast Terrazzo Finishing:

1. Finish exposed-to-view edges or reveals to match face finish.
2. Ease exposed edges to 1/8 in (3 mm) radius.

2.8 ELEVATOR CAR SUBSTRATE MATERIALS

A. Cementitious Backer Units:

1. Material Quality Standard: ANSI A118.9 or ASTM C 1325.
2. Description: Cementitious panels composed of portland cement, aggregates, glass mesh on both faces, and manufacturer proprietary ingredients; capable of remaining unaffected by prolonged exposure to water; 1/4 in (6 mm) thick.
3. Manufacturers and Products:

a. Custom Building Products; WonderBoard.
b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
c. National Gypsum Properties LLC.; PermaBase Cement Board.
d. United States Gypsum Company (USG); DUROCK Interior Cement Board.

B. Plywood: 3/4 in (19 mm) thick plywood complying with requirements of Division 06 Section "Miscellaneous Rough Carpentry".

2.9 CONCRETE MOISTURE BARRIER FLOOR TREATMENT

A. Epoxy-Based Moisture Barrier Floor Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, two-component, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete, prior to installation of impervious glued-down finish flooring specified in other Division 09 sections.

1. Basis of Design (Product Standard): Bostik, Inc.; D-250.

B. Cementitious Overcoat: Fast-setting latex-fortified Portland cement skim coating intended for interior uses.

1. Basis of Design (Product Standard): Bostik, Inc.; Webcrete 95.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Concrete Substrates:

1. Verify that concrete substrates are dry and free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo flooring. Determine adhesion and dryness characteristics by performing the following tests as recommended by terrazzo manufacturer.
    a. Bead-blast concrete substrate with an apparatus that abrades the surface, contains the dispensed shot within the apparatus, and re-circulates the shot by vacuum pickup.
    b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
    c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
2. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.
3. Moisture Testing: Perform one or both of the following tests as recommended by flooring manufacturer. Perform 3 moisture tests for first 1000 sf (92.9 sm) of concrete substrate scheduled to receive flooring and 1 test for each additional 1000 sf (92.9 sm) or fraction thereof. Proceed with installation only after concrete substrates pass testing.
    a. Anhydrous Calcium Chloride Test: Perform in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sf (1.36 kg of water/92.9 sm) in 24 hours.
    b. Relative Humidity Test: Using in situ probes, perform in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 80 percent relative humidity level measurement.
4. Moisture Barrier Floor Treatment: For concrete substrates not meeting moisture test standards specified above, apply epoxy-based moisture barrier floor treatment and cementitious overcoat to concrete substrate in accordance with manufacturer's written instructions.

C. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

3.4 INSTALLATION OF THIN-SET TERRAZZO

A. General:
1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
2. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide ".
3. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 in per 10 ft (6 mm per 3 m); noncumulative.
4. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
5. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

B. Thin-Set Terrazzo Thickness: 3/8 in (10 mm).

C. Flexible Reinforcing Membrane:
1. Prepare and prefill substrate cracks with membrane material.
2. Coverage:

a. Install membrane at substrate cracks in areas to receive terrazzo.
b. Install membrane to produce full substrate coverage in areas to receive terrazzo.

3. Prepare membrane according to manufacturer's written instructions before applying substrate primer.

D. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.

1. Strip Materials:

E. Divider and Control-Joint Strips:

1. Locate divider strips in locations indicated, but not to exceed 400 sf (37 sm).
2. Install control-joint strips back to back directly above concrete-slab control joints and construction joints (cold joints).
3. Install control-joint strips with 1/4 in (6 mm) gap between strips, and install sealant in gap.
4. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

F. Accessory Strips: Install as required to provide a complete installation.

G. Fine Grinding: Grind with 120 or finer grit stones until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.

H. Repair: Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as accepted by Architect.

3.5 INSTALLATION OF PRECAST RESINOUS TERRAZZO

A. Install precast terrazzo units using method recommended by NTMA and manufacturer unless otherwise indicated.

B. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8 in (3 mm) maximum in length, height, or width; noncumulative.

C. Do not install units that are chipped, cracked, discolored, or not properly finished.

D. Seal joints between units with joint sealant in accordance with Division 07 Section "Joint Sealants".

3.6 INSTALLATION OF THIN-SET TERRAZZO AT ELEVATOR CAR

A. Substrate: Install cementitious backer unit over plywood. Maintain top surface elevation of cementitious backer unit substrate such that finish level of terrazzo is level with elevator cab door threshold.

B. Flexible Reinforcing Membrane: Install membrane to produce full substrate coverage.

C. Thin-Set Terrazzo Thickness: 3/8 in (10 mm).

D. Perimeter Sealant Joint: Install 1/2 in (12 mm) sealant joint at elevator car perimeter complying with requirements of Division 07 Section "Joint Sealants".

3.7 CLEANING AND PROTECTION

A. Cleaning:

1. Remove grinding dust from installation and adjacent areas.

2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations.
2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

3.8 FINISH SCHEDULE

A. Terrazzo Color and Pattern:

B. Terrazzo Color and Pattern: Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

C. Terrazzo Color and Pattern: As selected by Architect from NTMA standard-terrazzo plates.

D. Terrazzo - TER01:

1. Color and Pattern: NTMA Plate No. XX
2. Divider Strips: [White zinc allow][Half-hard brass][Plastic]
3. Divider Strip Size: [1/8 in (3 mm)][1/4 in (6 mm)][3/8 in (10 mm)].

E. Strip Material

1. Top-Section Material: White zinc alloy.
2. Top-Section Material: Half-hard brass.
3. Top-Section Material: Plastic, in color selected by Architect from manufacturer's full range of colors.
4. Top-Section Width: 1/8 in (3 mm).
5. Top-Section Width: 1/4 in (6 mm).
6. Top-Section Width: 3/8 in (10 mm).

F. Precast Terrazzo Base Units:

1. Color and Pattern: Match adjacent terrazzo flooring.
2. Type: Coved with minimum 3/4 in (19 mm) radius.
3. Type: Straight.
4. Type: As indicated on drawings.
5. Top Edge (Concealed): Straight, unfinished.
6. Top Edge (Exposed): Beveled with polished top surface.
7. Top Edge (Exposed): Radius edge with polished top surface.
8. Height: 4 in (100 mm).
9. Height: 6 in (150 mm).
10. Height: As indicated on drawings

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 096723
RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resinous flooring systems, integral cove base, accessories and supplementary items for a complete installation.

1.2 ALLOWANCES

A. Concrete Moisture Barrier Allowance: Include allowance to provide negative side Concrete Moisture Barrier Floor Treatment to concrete floor decks exceeding moisture content recommended by flooring manufacturer.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance

B. Samples for Verification: For each resinous flooring system required, 6 in (150 mm) square, applied to a rigid backing by Installer for this Project.

C. Product Schedule: For resinous flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

D. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals. Submit manufacturer’s instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance. Include product data for flooring care products used or recommended by installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.

a. Provide a list of Projects that Installer has completed using the specified coating technology.

2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

a. Provide a letter from the Manufacturer stating the Installer is qualified to install the specified flooring system.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, apply full-thickness mockups on 96-inch- (2400-mm-) square floor area selected by Architect.

a. Show typical components and requirements of installation.
b. Include 96-inch (2400-mm) length of integral cove base.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion.

B. Installer’s Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer’s standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers/fabricators offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Flammability: Self-extinguishing in accordance with ASTM D635.

2.4 RESINOUS FLOORING (RF-01)

A. Resinous Flooring: Impact- and stain-resistant, decorative-flake-filled, hybrid-resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base.

B. System Characteristics:

1. Acceptable Manufacturers and Products:

a. Basis of Design: Stonhard; Stontec TRF.
b. Sherwin Williams; Hybri-Flex AC.
c. Sika Corp.; Sikafloor DecoFlake UEF.

2. Color and Pattern:

a. As scheduled or as indicated in Design Selections.

3. Wearing Surface: Textured for slip resistance.
4. Overall System Thickness: 3/16 in (5 mm).
5. Application Method: Troweled or screeded.

C. Mortar Base: Three component, troweled mortar system that is applied at an 1/8 in (3 mm).

D. Bonding Coat: Two-component, 100% solids, epoxy bonding coat. A colored coat that accepts the flakes.

E. Decorative Material: Flakes.

F. Topcoat: Sealing or finish coats: Two-component, UV resistant, aliphatic polyaspartic urethane sealer.

1. Basis of Design: Stonhard; Stonseal CA7

G. Second Topcoat for Operating Rooms: Sealing or finish coats: Two-component, non-reflective, waterborne, aliphatic polyurethane coating.

1. Basis of Design: Stonhard; Stonseal CF7.

H. Topcoat for Dining areas: Sealing or finish coats: Two-component, high solids, clear epoxy sealer.

1. Basis of Design: Stonhard; Stonkote CE4.
2. Sika Corp.; Sikafloor 225N.

I. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Slip Resistance: Meet or exceed a Dynamic Coefficient of Friction (DCOF) of 0.42 or a Static Coefficient of Friction (SCOF) of 0.6.

2.5 RESINOUS FLOORING (RF-02)

A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, aggregate-filled, urethane-resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base with self-leveling qualities.

B. System Characteristics:

1. Acceptable Manufacturers and Products:

a. Basis of Design: Stonhard; Stonres RTZ.
b. Sherwin Williams; Softop RXC.

2. Color and Pattern:

a. As scheduled or as indicated in Design Selections

3. Wearing Surface: Textured for slip resistance.
4. Overall System Thickness: 3/16 in (5 mm).
5. Application Method: Troweled or screeded.

C. Base Coat: Three-component, UV resistant, resilient urethane mortar consisting of urethane resin, curing agent, and coarse aggregate.

D. Grout Coat: Two-component, clear, UV resistant, aliphatic, polyaspartic urethane grout coat.

E. Topcoat: Sealing or finish coats: Two-component, non-reflective, waterborne, aliphatic polyurethane coating.

1. Basis of Design: Stonhard; Stonseal CF7.

F. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Slip Resistance: Meet or exceed a Dynamic Coefficient of Friction (DCOF) of 0.42 or a Static Coefficient of Friction (SCOF) of 0.6.

2.6 RESINOUS FLOORING (RF-03)

A. Resinous Flooring: Self-leveling, slurry-filled epoxy and decorative metallic system with a urethane top coat.

B. System Characteristics:

1. Acceptable Manufacturers and Products:

a. Basis of Design: DiamondStone, LLC; DiamondSlurry SL & Diamond Metallic with Eco-Top self-leveling, slurry-filled epoxy and decorative metallic system with a urethane top coat.
b. Sherwin Williams; ResuflorTopflor SL23 & Resuflor Topcoat Metallic.

2. Color and Pattern:

a. As scheduled or as indicated in Design Selections.

3. Wearing Surface: Textured for slip resistance.
4. Overall System Thickness: 3/16 in (5 mm).
5. Application Method: Notched rake or spike rolled.

C. Base Coat: Three-component, 100% solids, self-leveling epoxy flooring.

D. Topcoat: 100%-solids decorative topping.

E. Seal Coat: Two-component high-performance, aliphatic, moisture-cured urethane.

F. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Slip Resistance: Meet or exceed a Dynamic Coefficient of Friction (DCOF) of 0.42 or a Static Coefficient of Friction (SCOF) of 0.6.

2.7 RESINOUS FLOORING (RF-04)

A. Resinous Flooring: Self-leveling, liquid flooring system including a cementitious underlayment, primer and polymer formulation resin topcoat with or without decorative additives.

B. System Characteristics:

1. Acceptable Manufacturers and Products:

a. Basis of Design: Stonhard; Stoncrete SL1 Underlayment.

1) Finish System: Liquid Elements;

2. Color and Pattern:

a. As scheduled or as indicated in Design Selections.

3. Wearing Surface:
4. Overall System Thickness:
5. Application Method:

C. Underlayment: Self-leveling single component cementitious underlayment. Aggregate added as required for thickness.

D. Primer or Base Coat: Recommended by manufacturer.

E. Topcoat: As scheduled or as indicated in Design Selections.

F. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Slip Resistance: Meet or exceed a Dynamic Coefficient of Friction (DCOF) of 0.42 or a Static Coefficient of Friction (SCOF) of 0.6.

2.8 RESINOUS FLOORING (RF-05)

A. Resinous Flooring: A dense, liquid-rich, self-priming, textured, four component, polyurethane mortar system with a urethane-urea binder, pigments and graded quartz aggregates, abrasion and high temperature resistant monolithic floor surfacing designed to produce a seamless floor and integral cove base.

B. System Characteristics:

1. Acceptable Manufacturers and Products:

a. Basis of Design: Stonhard; Stonclad UT.
b. Sherwin Williams; Poly-Crete MDB with Accelera 4850 topcoat.
c. Sika Corp.; Purcem 19NA / Broadcast / Topcoat.

2. Color and Pattern:

a. As scheduled or as indicated in Design Selections.

3. Wearing Surface: Textured for slip resistance.
4. Overall System Thickness: 1/4 in (6mm).
5. Application Method: Notched trowel.

C. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Slip Resistance: Meet or exceed a Dynamic Coefficient of Friction (DCOF) of 0.42 or a Static Coefficient of Friction (SCOF) of 0.6.

2.9 RESINOUS FLOORING (RF-06)

A. Resinous Flooring: Durable, and slip, and impact resistant monolithic floor surfacing designed to produce a seamless floor and integral cove base.

B. System Characteristics:

1. Acceptable Manufacturers and Products:

a. Basis of Design: Stonhard; Stonshield HRI.
b. Sherwin Williams; Hybri-flex EQ.
c. Sika Corp.; Sikafloor DecoDur Quartz TG.

2. Color and Pattern:

a. As scheduled or as indicated in Design Selections.

3. Wearing Surface: Textured for slip resistance.
4. Overall System Thickness: 3/16 in (5 mm).
5. Application Method: Screed and troweled.

C. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Slip Resistance: Meet or exceed a Dynamic Coefficient of Friction (DCOF) of 0.42 or a Static Coefficient of Friction (SCOF) of 0.6.

2.10 RESINOUS FLOORING (RF-07)

A. Resinous Flooring: Monolithic floor surfacing designed to produce a seamless floor and integral cove base.

B. System Characteristics:

1. Acceptable Manufacturers and Products:

   a. Basis of Design: Stonhard; Stontec ERF.
   b. Sherwin Williams; Resuflor Deco Flake DQF.
   c. Sika Corp.; Sikafloor DecoDur Flake FX.

2. Color and Pattern:

   a. As scheduled or as indicated in Design Selections.

3. Wearing Surface: Textured for slip resistance.
4. Overall System Thickness: 1/8 in (3.2 mm).
5. Application Method: Squeegee.

C. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

   1. Slip Resistance: Meet or exceed a Dynamic Coefficient of Friction (DCOF) of 0.42 or a Static Coefficient of Friction (SCOF) of 0.6.

2.11 RESINOUS FLOORING (RF-08)

A. Resinous Flooring: Chemical-resistant epoxy floor surfacing designed to produce a seamless floor and integral cove base with a chemical-resistant epoxy topcoat.

B. System Characteristics:

   1. Acceptable Manufacturers and Products:

      a. Basis of Design: Stonhard; Stonclad GS with Stonkote HT4 topcoat.
      b. Sherwin Williams; Resuflor Screed TG 46 II with Resuflor 3741 Novolac Epoxy topcoat.
      c. Sika Corp.; Sikafloor Epo-Rok 160 with Purcem 19NA topcoat.

   2. Color and Pattern:

      a. As scheduled or as indicated in Design Selections.

   3. Wearing Surface: Textured for slip resistance.
   4. Overall System Thickness: Nominal 3/16 in (5 mm).
   5. Application Method: Screed and troweled base coat, squeegee and roll topcoat.

C. Base Coat: Three-component, troweled mortar base consisting of epoxy resin, curing agent and selected, graded aggregates.

D. Topcoat: Two component, 100%-solids epoxy coating.

E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

   1. Slip Resistance: Meet or exceed a Dynamic Coefficient of Friction (DCOF) of 0.42 or a Static Coefficient of Friction (SCOF) of 0.6.

2.12 RESINOUS FLOORING (RF-09)

A. Resinous Flooring: Monolithic floor surfacing designed to provide positive side waterproofing and to produce a seamless floor and integral cove base.

B. System Characteristics:

   1. Acceptable Manufacturers and Products:

      a. Basis of Design: Stonhard; Stongard MR.

b. Sherwin Williams; Resuflor Topfloor MER II.
c. Sika Corp.; Sikafloor Merflex Smooth.

2. Color and Pattern:

a. As scheduled or as indicated in Design Selections.

3. Wearing Surface: Textured for slip resistance.
4. Overall System Thickness: Nominal 30 to 40 mil / 0.75 to 1 mm.

C. Base Coat: Two-component, free flowing, 100% solids, urethane, elastomeric waterproof membrane.

D. Topcoat: Two component, 100%-solids epoxy coating.

E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Slip Resistance: Meet or exceed a Dynamic Coefficient of Friction (DCOF) of 0.42 or a Static Coefficient of Friction (SCOF) of 0.6.

2.13 ACCESSORIES

A. Primer: Type recommended by manufacturer for substrate and body coats indicated.

B. Waterproofing Membrane: Type recommended by manufacturer for substrate and primer and body coats indicated.

1. Acceptable Manufacturers and Products:

a. Basis of Design: Stonhard; Stonproof ME7.
b. Sherwin Williams; Resuflor 3555
c. Sika Corp.; Sikafloor 265.

C. Reinforcing Membrane: Flexible resin formulation that is recommended by manufacturer for substrate and primer and body coats indicated and that prevents substrate cracks from reflecting through resinous flooring.

D. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

2.14 CONCRETE MOISTURE BARRIER FLOOR TREATMENT (MOISTURE BARRIER PRIMER)

A. Epoxy-Based Moisture Barrier Floor Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete, prior to installation of resinous finish flooring.

1. Acceptable Manufacturers and Products: As recommended by resinous flooring manufacturer.

a. Basis of Design: Stonhard; Stondri MVT.
b. Sherwin Williams; Resuprime 3830/3835.
c. Sika Corp.; Sikafloor 1620.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting

performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

C. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Bead-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written recommendations for specified product(s).

a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) of slab area in 24 hours or as recommended by manufacturer for specified product(s).
b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement or at levels as recommended by manufacturer for specified product(s).

4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrates pass testing.
5. Moisture Barrier Floor Treatment: For concrete substrates not meeting moisture test standards specified by manufacturer for specified product(s), apply moisture barrier floor treatment to concrete substrate in accordance with manufacturer's written instructions.

D. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.

E. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.4 INSTALLATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Waterproofing Membrane: Apply waterproofing membrane on floors and to integral cove base substrates in manufacturer's recommended thickness.

1. Locations:

a. Kitchens and food service areas at elevated slabs above occupied areas.
b. Patient toilet rooms used as showers.
c. Locations indicated or scheduled on Drawings.

D. Reinforcing Membrane: Apply reinforcing membrane to substrates as recommended by manufacturer.

1. Locations:

a. Control joints and substrate cracks only at typical locations.
b. Where waterproof membrane is installed, apply at cracks wider than 1/16 inch only.
c. Entire substrate surface at composite deck assemblies and locations indicated or scheduled on Drawings.

E. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners. Extend integral cove base at top against metal cap strip.

1. Integral Cove Base: 6 in (150 mm) high.

F. Self leveling Body Coats: Apply self-leveling slurry body coats, or troweled or screeded body coats in thickness recommended by flooring system manufacturer. Hand or power trowel and grout to fill voids in troweled or screeded systems. When troweled or screeded systems are cured, remove trowel marks and roughness using method recommended by manufacturer.

1. Aggregates: Broadcast aggregates at rate recommended in writing by manufacturer. After resin is cured, remove excess aggregates to provide surface texture indicated.

G. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness specified for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended in writing by manufacturer.

H. Grout Coat: Apply grout coat to fill voids in surface of final body coat.

I. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor’s expense.

1. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
2. Core Sampling: At the direction of Owner and at locations designated by Owner, take one core sample per 1000 sq. ft. (92.9 sq. m) of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring and correct deficiencies.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

3.7 FINISH SCHEDULE

A. Color and Pattern: As selected by Architect from manufacturer's full range.

B. Color and Pattern: Match Architect's sample.

C. Color and Pattern:

D. RF01:

1. Manufacturer:
2. Color and Pattern:
3. Texture:
4. Thickness:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 096800
CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Carpeting products and systems and supplementary items necessary for installation.

B. Resilient wall base and resilient molding accessories installed with carpeting are specified in Division 09 Section "Resilient Base and Accessories".

1.2 ALLOWANCES

A. Concrete Moisture Barrier Allowance: Include allowance to provide Concrete Moisture Barrier Floor Treatment to concrete floor decks.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Provide floor plans, including columns, doorways, enclosing walls or partitions, built-in cabinets, and locations of cutouts, to indicate the following:

1. Carpeting type and color.
2. Seam locations, types, and methods.
3. Type of substrate.
4. Type of installation.
5. Pattern type, location, and direction.
6. Pile direction.
7. Type, color, and location of insets and borders.
8. Type, color, and location of edge, transition, and other accessory strips.
9. Transition details to other flooring materials.
10. Type of carpet cushion.

C. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

D. Samples for Verification Purposes: In manufacturer's standard size, but not less than 6 in by 9 in (150 mm by 230 mm) sample of each different color, texture, and pattern of carpeting product specified, showing the full range of variations expected in these characteristics. Label each sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in Schedules.

1. Seam Samples for Sheet Carpeting: Provide sample of sheet carpeting seam running lengthwise and in center of 6 in by 9 in (150 mm by 230 mm) sample prepared by installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Include in operation and maintenance manual as required by Division 01 Section "Closeout Procedures". Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling".

1.9 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity".

B. Environmental Limitations: Do not install carpeting until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Maintain carpeting products prior to installation at the same temperature as the space where they are to be installed.

D. Close spaces to traffic during carpeting installation and for time period after installation recommended by manufacturer.

E. Install carpeting products after other finishing operations, including painting, have been completed.

F. Do not install carpeting over concrete substrates until slabs have cured and are sufficiently dry to bond with adhesive, as determined by carpeting manufacturer's recommended tests. Refer to "Preparation" Article for requirements.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

A. Manufacturer's Warranty for Carpeting: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects

caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to more than 10 percent edge raveling, snags, runs, dimensional stability, loss of tuft bind strength, loss of face fiber, and delamination.
2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.

B. Manufacturer's Warranty for Carpet Cushion: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes consequent removal and replacement of carpeting and accessories.
2. Failure includes, but is not limited to, permanent indentation or compression.
3. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.

C. Warranty does not include deterioration or failure of carpeting due to unusual traffic, failure of substrate, vandalism, or abuse.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Emissions: Provide carpet that complies with testing and product requirements of CRI's "Green Label Plus" program.

2.3 TILE CARPETING

A. Basis of Design (Product Standard):

1. Selections: As scheduled or as indicated in Design Selections.

2.4 SHEET CARPETING

A. Basis of Design (Product Standard):

1. Selections: As scheduled or as indicated in Design Selections.

2.5 CARPET CUSHION

A. Traffic Classification: CCC Class II, heavy traffic or Class III, extra-heavy traffic, as required for carpet product selection.

B. Carpet Cushion: Fiber, rubber, or polyurethane carpet cushion as recommended by carpeting manufacturer for application, installation method, and traffic classification indicated.

2.6 ACCESSORY MATERIALS

A. Concrete Slab Primer: Non-staining type as recommended by carpeting manufacturer.

B. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpeting manufacturer.

C. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpeting and is recommended or provided by carpeting manufacturer.

D. Seaming Adhesive for Sheet Carpet: Hot-melt adhesive tape or similar product recommended by carpeting manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

E. Tackless Carpet Stripping for Padded Sheet Carpeting Stretch-In Installation: Water-resistant plywood, in strips as required to match carpet cushion thickness and that comply with CRI 104, Section 12.2.

F. Concrete Moisture Barrier Floor Treatment:

1. Epoxy-Based Moisture Barrier Floor Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, two-component, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete, prior to installation of impervious glued-down finish flooring specified in other Division 09 sections.

a. Basis of Design (Product Standard): Bostik, Inc.; D-250.

2. Cementitious Overcoat: Fast-setting latex-fortified Portland cement skim coating intended for interior uses.

a. Basis of Design (Product Standard): Bostik, Inc.; Webcrete 95.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation" and carpeting manufacturer's written installation instructions for preparing substrates indicated to receive carpeting installation.

C. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that concrete substrate finishes comply with requirements specified in Division 03 Section "Concrete Finishing" for concrete substrates receiving carpeting.
2. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.
3. Verify that concrete substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Unless concrete has been water-cured, then proceed with the following:

   a. Bead-blast concrete substrate with an apparatus that abrades the surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
   b. Repair damaged and deteriorated concrete according to flooring manufacturer's written recommendations.

4. Determine adhesion and dryness characteristics by performing the following tests as recommended by flooring manufacturer.
5. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. A pH range of 5 to 9 is required when substrate is wetted with distilled water and pHydrion paper is applied. Proceed with installation only after concrete substrates pass testing.
6. Moisture Testing: Perform one or both of the following tests as recommended by flooring manufacturer. Perform 3 moisture tests for first 1000 sf (92.9 sm) of concrete substrate scheduled to receive flooring and 1 test for each additional 1000 sf (92.9 sm) or fraction thereof. Proceed with installation only after concrete substrates pass testing.

   a. Perform anhydrous calcium chloride test in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sf (1.36 kg of water/92.9 sm) in 24 hours.
   b. Perform relative humidity test using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 75 percent relative humidity level measurement.

7. Moisture Barrier Floor Treatment: For concrete substrates not meeting moisture test standards specified above, apply epoxy-based moisture barrier treatment and cementitious overcoat to concrete substrate in accordance with manufacturer's written instructions.

D. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

E. Broom and vacuum clean substrates to be covered immediately before installing carpeting. After cleaning, reexamine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION OF CARPETING

A. Scribe, cut, and fit carpeting to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

B. Extend carpeting into toe spaces, door reveals, closets, and similar openings. Extend carpeting to center of door openings.

C. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish carpeting as marked on substrate. Use chalk or other nonpermanent, non-staining marking device.

D. Do not bridge building expansion joints with carpet.

E. Bind or seal cut edges as recommended by carpeting manufacturer.

F. Install pattern parallel to walls and borders unless otherwise indicated.

G. Hand-roll carpeting in both directions from center out to embed carpeting in adhesive and eliminate trapped air according to manufacturer's written instructions. At walls, door casings, and other locations where access by roller is impractical, press carpeting firmly in place with flat-bladed instrument.

3.5 INSTALLATION OF TILE CARPETING

A. Tile Carpet at Concrete Substrates: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)" and carpet manufacturer's written recommendations for full glue-down installation of every tile with releasable adhesive.

B. Install pattern parallel to walls and borders unless otherwise indicated.

3.6 INSTALLATION OF ADHERED SHEET CARPETING

A. Apply concrete slab primer, if recommended by carpeting manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

B. Sheet Carpet at Concrete Substrates without Padding: Comply with CRI 104, Section 9, "Direct Glue-Down Installation" and carpeting manufacturer's written installation instructions for direct-glue-down installation.

C. Sheet Carpet at Concrete Substrates with Padding: Comply with CRI 104, Section 10, "Double-Glue-Down Installation" and carpeting manufacturer's written installation instructions for double-glue-down installation.

1. Comply with carpet cushion manufacturer's written recommendations. Install carpet cushion seams at 90-degree angle with carpet seams.

D. Adhere to concrete substrates using a full spread of adhesive applied to substrate to comply with carpeting manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

E. Comply with carpeting manufacturer's written recommendations for seam locations and direction of carpeting; maintain uniformity of carpeting direction and lay of pile. At doorways, center seams under the door in closed position.

3.7 INSTALLATION OF STRETCH-IN SHEET CARPETING

A. Comply with carpet cushion manufacturer's written recommendations. Install carpet cushion seams at 90-degree angle with carpeting seams.

B. Stretch-in Carpeting Installation: Comply with CRI 104, Section 12, "Stretch-in Installations".

C. Comply with carpeting manufacturer's written recommendations for seam locations and direction of carpeting; maintain uniformity of carpeting direction and lay of pile. At doorways, center seams under the door in closed position.

3.8 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpeting:

1. Remove excess adhesive and other surface blemishes from exposed surfaces using cleaner recommended by carpeting manufacturer.
2. Remove yarns that protrude from carpeting surface.
3. Vacuum carpeting using commercial machine with face-beater element.

B. Protect installed carpeting to comply with CRI 104, Section 16, "Protecting Indoor Installations".

C. Protect carpeting against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpeting manufacturer.

3.9 CARPETING SCHEDULE

A. Selections: As selected by Architect from full range of industry colors.

B. Tile Carpeting:

1. CPT01:

a. Manufacturer:
b. Name:
c. Series:
d. Pattern:
e. Number:
f. Size:
g. Color Selection:

C. Sheet Carpeting:

1. CP01:

a. Manufacturer:
b. Name:
c. Series:
d. Pattern:
e. Number:
f. Color Selection:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 097200
WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wall coverings and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, installation instructions, and recommendations for maintenance.
2. Include data on physical characteristics, durability, fade resistance, and flame resistance characteristics.

B. Shop Drawings: Show location and extent of each wall covering type. Indicate seams and termination points.

C. Samples for Verification Purposes: Sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. Full-width sample, not less than 36 in (900 mm) long, from dye lot used for the Work.
2. Submit sample with specified treatments applied for products specified.
3. Show complete pattern repeat where applicable.

D. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: As follows, per ASTM E 84:

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.

3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Do not install wall coverings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

B. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1. Wood-Veneer Wall Coverings: Condition spaces for not less than 48 hours before installation.

C. Lighting: Do not install wall covering until a lighting level of not less than 15 foot-candles (160 lux) is provided on the surfaces to receive wall covering.

D. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering manufacturer for full drying or curing.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on product and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 WALL COVERING MATERIALS

A. Vinyl Wall Covering: Provide integrally pigmented, opaque virgin vinyl calendared film vinyl wall covering material treated with mildew and antimicrobial additives and laminated to suitable backing. Comply with FS CCC-W-408D, Type II (except where Type I is specifically scheduled), Class 1, and CFFA W-101-D.

1. Stain-Resistant: Provide material for toilet rooms wet walls with delustered clear polyvinyl fluoride film not less than 0.0005 in (1/2 mil) thick as top coating complying with FS L-P-1040, Type I, Grade B, Class 2 (DuPont "Tedlar"). Do not include weight of stain-resistant coating as part of required vinyl coating weight or total fabric weight.

B. Textile Wall Coverings: Provide textile wall fabric affixed to suitable backing, and complying with requirements of ASTM F 793, Category III, Decorative with High Serviceability. Provide material which has been treated for stain and mildew resistance.

C. Wallpaper: Provide printed wallpaper complying with requirements of ASTM F 793, Category I, Decorative Only.

D. Wood Veneer Wall Covering:

1. Species and Graining: Refer to Basis of Design (Product Standard) portion of this Specification.
2. Matching and Numbering: Each sheet shall be architecturally matched and sheets numbered in sequence for perfect continuity on the wall (except Random or Staved grade).
3. Finish: Factory applied using wall-covering manufacturer's standard stain and polyurethane system.

a. Colors: Match Architect's sample.

2.4 ACCESSORY ITEMS

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.

B. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator’s written installation instructions.

2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

C. Comply with manufacturer's written instructions for surface preparation.

D. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.

1. Prime new gypsum board with primer recommended by wall covering manufacturer.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Wall Liner: Where recommended by wall covering manufacturer install wall liner to form smooth wrinkle-free surface for finished installation. Do not begin wall covering installation until wall liner has dried.

3.4 INSTALLATION OF WALL COVERINGS

A. Comply with wall coverings manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Cut wall covering panels in roll number sequence. Change run numbers at partition breaks and corners only.

C. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage. Install seams vertical and plumb at least 6 in (150 mm) from outside corners and 3 in (75 mm) from inside corners. No horizontal seams are permitted.

D. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

E. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams without any overlay or spacing between strips.

3.5 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces. Use cleaning methods recommended by the wall covering manufacturer.

B. Replace strips that cannot be cleaned.

C. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

3.6 WALL COVERING SCHEDULE

A. Selection: As selected by Architect from manufacturer's standand colors and patterns.

B. Selection:

1. Manufacturer:
2. Type:
3. Style:
4. Color Selection:

C. Type WC01:

1. Manufacturer:
2. Type:
3. Style:
4. Color Selection:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 097213
TACKBOARD WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Tackboard wall coverings and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Indicate seams and termination points.

C. Samples for Verification Purposes: Full width by 36 in (914 mm) long section of tackboard wall covering.

D. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: As follows, per ASTM E 84:

a. Flame-Spread Index: 75 or less (Class B).
b. Smoke-Developed Index: 450 or less.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.

5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Do not install wall coverings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

B. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering manufacturer for full drying or curing.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on product and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: Forbo Flooring Systems; Bulletin Board.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 TACKBOARD WALL COVERING MATERIALS

A. Tackboard Wall Covering: 1/4 in (6 mm) thick, seamless, homogeneous tackable surface material made of primary natural materials consisting of linseed oil, cork, rosin binders and dry pigments mixed and calendared onto a natural jute backing. Integral color extends throughout the thickness of the material.

1. Selections: As scheduled or as indicated in Design Selections.

B. Adhesive: Mildew-resistant, non-staining for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

C. Comply with manufacturer's written instructions for surface preparation.

D. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.

1. Prime new gypsum board with primer recommended by wall covering manufacturer.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

3.4 INSTALLATION OF WALL COVERINGS

A. Comply with wall coverings manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage. Install seams vertical and plumb at least 6 in (150 mm) from outside corners and 3 in (75 mm) from inside corners. No horizontal seams are permitted.

C. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

D. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams without any overlay or spacing between strips.

3.5 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces. Use cleaning methods recommended by the wall covering manufacturer.

B. Replace strips that cannot be cleaned.

C. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

3.6 FINISH SCHEDULE

A. Selection: As selected by Architect from manufacturer's standard colors and patterns.

B. Selection:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 098433
ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes acoustical wall panels and supplementary items necessary to complete their installation.

B. Refer to Division 9 “Fabric-Wrapped Panels” for custom-fabricated wall panels.

C. Refer to Division 9 Section "Stretched-Fabric Wall Systems" for site-upholstered wall systems.

D. Refer to Division 9 Section "Wall Coverings" for direct glued fabric wall covering.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for acoustical wall panels, including plans, elevations, sections, details, and attachments to other Work. Show orientation of fabric application, pattern matching, and seams.

C. Samples for Verification: 8 in (200 mm) by 11 in (275 mm) units of each type of acoustical wall panel indicated; in sets for each color, texture, and pattern specified for facing materials, showing the full range of variations expected in these characteristics. Include samples of installation devices and accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: Signed by manufacturers of acoustical wall panels certifying that products furnished comply with requirements.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For acoustical wall panels and facings to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing acoustical wall panels similar to those indicated for this Project and with a record of successful in-service performance.

B. Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical wall panels with appropriate markings of applicable testing and inspecting agency.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

C. Mockup: Before installing acoustical wall panels, build mockup for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockup in the location and of the size indicated or, if not indicated, a minimum of three panels.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical wall panels from excessive moisture when shipping, storing, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet-work, such as concrete and plaster, has been completed and cured to a condition of equilibrium. Protect panel edges from crushing and impact.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical wall panels until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

C. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 WARRANTY

A. Special Warranty: Written warranty, signed by manufacturer agreeing to repair or replace components of acoustical wall panel system that fail in performance, materials, or workmanship within specified warranty period. Failure in performance includes, but is not limited to, acoustical performance. Failure in materials includes, but is not limited to, sagging or distortion of facing or warping of core.

B. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Acoustical Wall Panels: Obtain acoustical wall panels from one source with resources to provide products of consistent quality in appearance and physical properties.

2.2 ACOUSTICAL WALL PANELS

A. Provide manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass fiber board core; with edges chemically hardened to reinforce panel perimeter against warpage and damage.

1. Panel Selection: Refer to Schedule at end of this Section.
2. Panel Selection: Refer to Division 1 Section “Design Selections”

B. Fabricate panels to sizes and configurations indicated; attach facing materials to cores to produce installed panels with visible surfaces fully covered and free from waves in fabric weave, wrinkles, sags, blisters, seams, adhesive, or other foreign matter.

1. Fabricate back-mounted panels in factory to exact sizes required to fit wall surfaces, based on field measurements of completed substrates indicated to receive acoustical wall panels.
2. Tailor corners and attach facing material so there are no seams or gathering of material.
3. Where fabrics with directional or repeating patterns, or directional weave, are indicated, mark fabric top and attach fabric in same direction.
4. Where fabric facings with seams are indicated, fabricate invisible seams and comply with Shop Drawings for location.

C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 in (1.5 mm) for width length, straightness, squareness, and thickness.

D. Sound-Absorption Performance: Provide acoustical wall panels with minimum noise reduction coefficients indicated, as determined by testing per ASTM C 423 for mounting type specified under individual product requirements in the Acoustical Wall Panel Schedule.

E. Panel Characteristics: Comply with requirements indicated in the Acoustical Wall Panel Schedule.

F. Spline-Mounting Accessories: Manufacturer's standard concealed, extruded-aluminum or plastic connecting splines designed and fabricated for screw attachment to walls, with other moldings and trim for interior and exterior corners, leveling and base support, and as required. Provide panel manufacturer's standard factory-applied finish on exposed items in color as selected.

G. Back-Mounting Accessories: Manufacturer's standard or recommended accessories for securely mounting panels, of type and size indicated, to substrates provided; and complying with the following requirements:

1. Mechanically Mounted Edge-Reinforced Panels: Metal panel-clip and base-support bracket system consisting of two-part panel clips, with one part of each clip mechanically attached to back of panel and the other part to wall substrate, designed to support panels laterally; and base-support brackets designed to support full weight of panels; with both designed to allow for panel removal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates surfaces to receive acoustical wall panels and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer’s acceptance of surface conditions.

3.2 INSTALLATION

A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, and scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's written instructions for installation of panels using type of mounting accessories indicated or, if not indicated, as recommended by manufacturer.

B. Construction Tolerances: As follows:

1. Variation from Plumb and Level: Plus or minus 1/16 in (1.5 mm).
2. Variation of Joints from Hairline: Not more than 1/16 in (1.5 mm).

3.3 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

C. Remove surplus materials, rubbish, and debris resulting from acoustical wall panel installation, on completion of the Work, and leave areas of installation in a neat and clean condition.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure acoustical wall panels are without damage or deterioration at time of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired, before time of Substantial Completion.

3.5 ACOUSTICAL WALL PANEL SCHEDULE

A. AP01:

1. Manufacturer:
2. Panel designation:
3. Facing Material: Manufacturer’s standard fabric from same dye lot; color and pattern as selected by Architect from manufacturer’s full range.
4. Nominal Core Density: Not less than 13 lb/cu. ft.
5. Panel Thickness: 3/4 inch unless otherwise indicated.
6. Noise Reduction Coefficient: For Type A mounting per ASTM E 795 NRC 0.50 to 0.90.
7. Panel Width: Manufacturer’s standard.
8. Panel Height: As indicated

B. AP02:

1. Manufacturer:
2. Panel designation:
3. Facing Material: Manufacturer’s standard fabric from same dye lot; color and pattern as selected by Architect from manufacturer’s full range.
4. Nominal Core Density: Not less than 13 lb/cu. ft.
5. Panel Thickness: 3/4 inch unless otherwise indicated.
6. Noise Reduction Coefficient: For Type A mounting per ASTM E 795 NRC 0.50 to 0.90.
7. Panel Width: Manufacturer’s standard.
8. Panel Height: As indicated

END OF SECTION

SECTION 099100
PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and field painting of exposed interior items, exterior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where indicated that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels, unless indicated otherwise.

1. Prefinished items include the following factory-finished components:

a. Prefinished wood doors.
b. Acoustical materials.
c. Prefinished Architectural woodwork and cabinets.
d. Elevator equipment.
e. Finished mechanical and electrical equipment.
f. Light fixtures.
g. Distribution cabinets.
h. Baked enamel coated items.
i. Fluoropolymer coated items.
j. Integral colored plaster.
k. Integral colored PVC.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.
g. Elevator shafts.

3. Finished metal surfaces include the following:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper and copper alloys.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

a. Embossed UL labels may be used and painted where acceptable to authority having jurisdiction

D. Related Sections:

1. Division 09 Section "Gypsum Board Assemblies" for surface preparation of gypsum board assemblies.
2. Division 09 Section "High-Performance Coatings" for coatings applied over such substrates as concrete and GFRC, steel, galvanized metal, and aluminum (not anodized or otherwise coated) that are not specified in this Section.

1.2 SPECIAL PAINTING REQUIREMENTS

A. Access panels shall be field painted in place after installation with panels in open position and allowed to completely dry

1. Sheen at Ceilings: Flat unless indicated otherwise.
2. Sheen at Walls: Eggshell unless indicated otherwise.
3. Sheen at Wall Trim: Semi-gloss unless indicated otherwise.

B. Outlet and other receptacle plates (including but not limited to plug, switch and A/V cover plates; speaker grilles; and HVAC terminal devices) shall be field spray painted off-the-walls/ceilings to match the adjacent finish. Install plates and grilles after completely dried.

1. Sheen at Walls/Ceilings: Satin unless indicated otherwise.
2. Sheen at Trim: Semi-gloss unless indicated otherwise.

C. Outlet and other receptacle plates and access panels located in stone or woodwork with transparent finish shall be field faux paint finished to match the adjacent finish.

1.3 DEFINITIONS

A. MPI Gloss Levels: MPI Gloss and Sheen Standard values are measured per ASTM D523, Method D and are as follows:

1. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees.
2. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
4. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
5. Gloss Level 5: 35 to 70 units at 60 degrees.
6. Gloss Level 6: 70 to 85 units at 60 degrees.
7. Gloss Level 7: More than 85 units at 60 degrees.

B. Exterior Painting: Generally includes surfaces located in unconditioned spaces.

C. Interior Painting: Generally includes surfaces located in conditioned spaces.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, installation instructions, and recommendations for maintenance.

B. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 in (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturers Project Acceptance Document: Certification that products are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that warranty will be issued.

1. Certifications by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" and "MPI Maintenance Repainting Manual" for products and paint systems indicated.

C. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockup in the location and of the size indicated or, if not indicated, as directed by Architect.

a. Architect will select one surface to represent surfaces and conditions for application of each paint system.

1) Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
2) Other Items: Architect will designate items or areas required.
3) Demonstrate repair procedures for damaged surfaces.

b. Apply samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
c. Final approval of color selections will be based on benchmark samples.

1) If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.9 PROJECT CONDITIONS

A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between minimum and maximum range recommended by manufacturer.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include but are not limited to those listed.

B. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

C. Manufacturers:

1. Behr.
2. Benjamin Moore & Co.
3. Dunn-Edwards Corporation.
4. Pittsburg Paints Company.
5. Sherwin-Williams Company (The).
6. Valspar.

D. Color and Gloss: As scheduled or as indicated in Design Selections.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Source Limitations: Obtain block fillers and field applied primers for each coating system from the same manufacturer as the finish coats.

C. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to shop applicators to ensure use of compatible primers.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to the following, unless otherwise specified in this Section:

1. Respective manufacturer's written installation instructions.
2. Approved submittals.
3. Contract Documents.
4. MPI Architectural Painting Specification Manual" or "MPI Maintenance Repainting Manual", as applicable.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" and "MPI Maintenance Repainting Manual" applicable to substrates and paint systems indicated.

C. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates, unless expressly permitted by authorities having jurisdiction for labels intended to be painted.

D. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

E. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

1. Use mechanical methods of surface preparation recommended by paint manufacturer.
2. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

F. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.

G. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

H. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

1. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

I. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

1. Galvanized metal substrates shall not be chromate passivated. If galvanized metal is chromate passivated, provide surface preparation and primers recommended by manufacturer.

J. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Plastic Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

L. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

M. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.

N. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items, equipment, and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items, equipment, or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
5. The number of coats and film thickness required are the same regardless of application method.
6. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
7. Omit primer over metal surfaces that have been shop primed and touchup painted.
8. Allow sufficient time between successive coats to permit proper drying.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat. Tint per manufacturer's technical data for each type of primer or undercoat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve total dry film thickness of the entire system as recommended by manufacturer.

3.5 MECHANICAL AND ELECTRICAL WORK PAINTING AND IDENTIFICATION

A. Painting of Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work to be done when exposed in the following locations:

1. Equipment Rooms.
2. Occupied Spaces.
3. Exterior Walls.
4. Roof Areas.
5. Parking Garages.
6. Building Piping located throughout the building: Provide complete painting of all piping or piping identification as requested by Owner.

B. Equipment includes, but is not limited to, the following:

1. Uninsulated piping.
2. Pipe hangers and supports.
3. Tanks that do not have factory-applied final finishes.
4. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
5. Equipment that is indicated to have a factory-primed finish for field painting.

C. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces. Paint with a flat, nonspecular black paint.

D. Pipe Identification: Conform to requirements of ANSI/ASME A13.1 "Scheme for the Identification of Piping Systems".

3.6 FIRE AND SMOKE BARRIER IDENTIFICATION

A. Fire and smoke resistant rated walls shall be effectively and permanently identified with signs, labels or stencils in a manner acceptable to authority having jurisdiction.

1. Identification shall be above decorative ceiling and in concealed spaces, on each segment of the wall and 6'-0" O.C. maximum on each side of wall.

3.7 FIELD QUALITY CONTROL

A. Owner Testing Agency: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of paint materials with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.8 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces to match approved samples.

3.9 SPECIAL PAINT FINISHES

A. Lime Based Paints:

1. Basis of Design Manufacturer and Products: Graphenstone; GrafClean Premium Paints.

a. Selections: System and finish as scheduled or indicated in Design Selections.

2. Substrate Preparation: Prepare substrate as recommended by manufacturer.
3. Prime Coat: Primer as recommended by manufacturer. All surfaces shall be primed prior to applying finish.
4. Intermediate Coat: Lime based matching topcoat.
5. Topcoat: Lime based topcoat.

3.10 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex Over Alkali-Resistant Primer System: MPI EXT 3.1A.

a. Prime Coat: Primer, alkali resistant, water based, MPI #3.

1) Basis of Design: Sherwin Williams; Loxon Primer Sealer LX02W50.

b. Intermediate Coat: Exterior latex matching topcoat.
c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Basis of Design: Sherwin Williams; Latitude Exterior Flat, K60 Series.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Basis of Design: Sherwin Williams; Latitude Exterior Satin, K62 Series.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Basis of Design: Sherwin Williams; Latitude Exterior Gloss, K64 Series.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series.

B. Clay-Masonry Substrates:

1. Latex System: MPI EXT 4.1A.

a. Prime Coat: Primer, alkali resistant, water based, MPI #3.

1) Basis of Design: Sherwin Williams; Loxon Primer Sealer LX02W50.

b. Intermediate Coat: Exterior latex matching topcoat.
c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Basis of Design: Sherwin Williams; Latitude Exterior Flat, K60 Series.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Basis of Design: Sherwin Williams; Latitude Exterior Satin, K62 Series.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Basis of Design: Sherwin Williams; Latitude Exterior Gloss, K64 Series.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series.

C. CMU Substrates:

1. Latex System: MPI EXT 4.2A.

a. Prime Coat: Block filler, latex, interior/exterior, MPI #4.

1) Basis of Design: Sherwin Williams; Pro Industrial Heavy Duty Block Filler B42W150.

b. Intermediate Coat: Exterior latex matching topcoat.
c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Basis of Design: Sherwin Williams; Latitude Exterior Flat, K60 Series.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Basis of Design: Sherwin Williams; Latitude Exterior Satin, K62 Series.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Basis of Design: Sherwin Williams; Latitude Exterior Gloss, K64 Series.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000. Series

g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

D. Cementitious Composition Board Substrates:

1. Latex System: MPI EXT 3.3J.

a. Prime Coat: Primer, alkali resistant, water based, MPI #3.

1) Basis of Design: Sherwin Williams; Loxon Primer Sealer LX02W50.

b. Intermediate Coat: Exterior latex matching topcoat.

c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Basis of Design: Sherwin Williams; Latitude Exterior Flat, K60 Series.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Basis of Design: Sherwin Williams; Latitude Exterior Satin, K62 Series.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Basis of Design: Sherwin Williams; Latitude Exterior Gloss, K64 Series.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections

E. Stucco (Portland Cement Plaster) Substrates:

1. Latex over Alkali-Resistant, Water-Based Primer System: MPI EXT 9.1J.

a. Prime Coat: Primer, alkali resistant, water based, MPI #3.

1) Basis of Design: Sherwin Williams; Loxon Primer Sealer LX02W50.

b. Intermediate Coat: Exterior latex matching topcoat.

c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Basis of Design: Sherwin Williams; Latitude Exterior Flat, K60 Series.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Basis of Design: Sherwin Williams; Latitude Exterior Satin, K62 Series.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Basis of Design: Sherwin Williams; Latitude Exterior Gloss, K64 Series.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

F. Steel Substrates (Ferrous Metal):

1. Water-Based, Light-Industrial Coating System: MPI EXT 5.1M

a. Prime Coat: Rust-inhibitive primer, (water based), primer, MPI #107.

1) Basis of Design: Sherwin Williams; Pro Ind Pro-Cryl Primer B66-1300.

b. Intermediate Coat: Water-based, light-industrial coating, matching topcoat.

c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1200 Series.

d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1100 Series.

e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), MPI #164.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series.

f. Gloss and Sheen: As scheduled or as indicated in Design Selections.

2. High-Heat-Resistant Coating System: MPI EXT 5.2D.

a. Prime Coat: Primer recommended in writing for use in coating system and under conditions indicated by manufacturer of topcoat.

b. Top Coat(s): Aluminum paint, high heat, (MPI #22).

1) Basis of Design: Sherwin Williams; Heat Flex Hi-Temp Aluminum B58SX820.

2) Provide number of topcoats recommended in writing for use in coating system and under conditions indicated by manufacturer but not less than two.

G. Galvanized-Metal Substrates:

1. Water-Based, Light-Industrial Coating System: MPI EXT 5.3J.

a. Prime Coat: Waterborne galvanized-metal primer, MPI #134.

1) Basis of Design: Sherwin Williams; Pro Ind Pro-Cryl Primer B66-1300 .

b. Intermediate Coat: Water-based, light-industrial coating, matching topcoat.

c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1200 Series .

d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1100 Series

e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), MPI #164.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series

f. Gloss and Sheen: As scheduled or as indicated in Design Selections.

H. Dressed Lumber Substrates: Including architectural woodwork and doors.

1. Latex System: MPI EXT 6.3L.

a. Prime Coat: Exterior latex wood primer, MPI # 6.

1) Basis of Design: Sherwin Williams; Exterior Latex Wood Primer B42W8141.

b. Intermediate Coat: Exterior latex matching topcoat.
c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Basis of Design: Sherwin Williams; Latitude Exterior Flat, K60 Series.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Basis of Design: Sherwin Williams; Latitude Exterior Satin, K62 Series.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Basis of Design: Sherwin Williams; Latitude Exterior Gloss, K64 Series.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

I. Wood Panel Substrates: Including plywood siding, fascias, soffits.

1. Latex System: MPI EXT 6.4K.

a. Prime Coat: Exterior latex wood primer, MPI # 6.

1) Basis of Design: Sherwin Williams; Exterior Latex Wood Primer B42W8141.

b. Intermediate Coat: Exterior latex matching topcoat.
c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Basis of Design: Sherwin Williams; Latitude Exterior Flat, K60 Series.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Basis of Design: Sherwin Williams; Latitude Exterior Satin, K62 Series.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Basis of Design: Sherwin Williams; Latitude Exterior Gloss, K64 Series.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

J. Wood Shingle and Shake Substrates (Excluding Roofs):

1. Latex System: MPI EXT 6.6E.

a. Prime Coat: Exterior latex wood primer, MPI # 6.

1) Basis of Design: Sherwin Williams; Exterior Latex Wood Primer B42W8141.

b. Intermediate Coat: Exterior latex matching topcoat.

c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Basis of Design: Sherwin Williams; Latitude Exterior Flat, K60 Series.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Basis of Design: Sherwin Williams; Latitude Exterior Satin, K62 Series.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Basis of Design: Sherwin Williams; Latitude Exterior Gloss, K64 Series.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

K. Dimension Lumber Substrates, Nontraffic Surfaces: Including board siding, fencing, undersides of decking.

1. Latex System: MPI EXT 6.2M.

a. Prime Coat: Exterior latex wood primer, MPI # 6.

1) Basis of Design: Sherwin Williams; Exterior Latex Wood Primer B42W8141.

b. Intermediate Coat: Exterior latex matching topcoat.

c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

1) Basis of Design: Sherwin Williams; Latitude Exterior Flat, K60 Series.

d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

1) Basis of Design: Sherwin Williams; Latitude Exterior Satin, K62 Series.

e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Basis of Design: Sherwin Williams; Latitude Exterior Gloss, K64 Series.

f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.

1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

L. Plastic Substrates:

1. Latex System MPI EXT 6.8A:
   a. Prime Coat: Primer, bonding, water based, MPI #17.
      1) Basis of Design: Sherwin Williams; Extreme Bond Primer B51W1150.
   b. Intermediate Coat: Latex, exterior, matching topcoat.
   c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.
      1) Basis of Design: Sherwin Williams; Latitude Exterior Flat, K60 Series.
   d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
      1) Basis of Design: Sherwin Williams; Latitude Exterior Satin, K62 Series.
   e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.
      1) Basis of Design: Sherwin Williams; Latitude Exterior Gloss, K64 Series.
   f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), MPI #119.
      1) Basis of Design: Sherwin Williams; Pro Industrial DTM Acrylic B66-1000 Series.

3.11 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:
   1. High-Performance Architectural Latex System: MPI INT 3.1C.
      a. Prime Coat: Interior alkali-resistant, water-based primer, MPI #3.
         1) Basis of Design: Sherwin Williams; Loxon Primer Sealer LX02W50.
      b. Intermediate Coat: High-performance architectural latex matching topcoat.
      c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.
         1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low-gloss Eg-shel B41-1900 Series.
      d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.
         1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.
      e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.
         1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.
      f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.
         1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.
      g. Gloss and Sheen: As scheduled or as indicated in Design Selections.
   2. Institutional Low-Odor/VOC Latex System: MPI INT 3.1M.
      a. Prime Coat: Institutional Low-Odor/VOC Primer/Sealer, MPI #149.

1) Basis of Design: Sherwin Williams; ProMar 200 0 VOC Primer B28W2600.

b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Flat B30-2900.

d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), MPI #144.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-shel B41-1900 Series..

e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Gloss B66-600 Series.

i. Gloss and Sheen: As scheduled or as indicated in Design Selections.

3. Water-Based Epoxy Coating System: MPI 3.1G.

a. Prime Coat: Epoxy-Modified Latex, Interior, matching topcoat.
b. Intermediate Coat: Epoxy-Modified Latex, Interior, matching topcoat.
c. Topcoat: Epoxy-Modified Latex, Interior, semi-gloss (MPI Gloss Level 5), MPI #215.

1) Basis of Design: Sherwin Williams; Pro Industrial Waterbased Catalyzed Epoxy B73-360 Series.

d. Topcoat: Epoxy-Modified Latex, Interior, gloss (MPI Gloss Level 6), MPI #115.

1) Basis of Design: Sherwin Williams; Pro Industrial Waterbased Catalyzed Epoxy B73-300 Series.

e. Gloss and Sheen: As scheduled or as indicated in Design Selections.

B. Concrete Substrates, Traffic Surfaces:

1. Latex Floor Enamel System MPI INT 3.2A:

a. Prime Coat: Floor paint, latex, matching topcoat.
b. Intermediate Coat: Floor paint, latex, matching topcoat.
c. Topcoat: Floor paint, latex, low gloss (maximum MPI Gloss Level 3), MPI #60.

1) Basis of Design: Sherwin Williams; Armorseal Tread-Plex B90 Series.

C. Clay-Masonry Substrates:

1. High-Performance Architectural Latex System: MPI INT 4.1L.

a. Prime Coat: Interior alkali-resistant, water-based primer, MPI #3.

1) Basis of Design: Sherwin Williams; Loxon Primer Sealer LX02W50.

b. Intermediate Coat: High-performance architectural latex matching topcoat.

c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-Shel B41-1900 Series.

d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series

f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic B66-650 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

2. Institutional Low-Odor/VOC Latex System: MPI INT 4.1M.

a. Prime Coat: Institutional Low-Odor/VOC Primer/Sealer, MPI #149.

1) Basis of Design: Sherwin Williams; ProMar 200 0 VOC Primer B28W2600.

b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Flat B30-2900.

d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), MPI #144.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-shel B41-1900 Series.

e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Gloss B66-600 Series.

i. Gloss and Sheen: As scheduled or as indicated in Design Selections.

3. Water-Based Epoxy Coating System: MPI INT 4.1G.

a. Prime Coat: Epoxy-Modified Latex, Interior, matching topcoat.
b. Intermediate Coat: Epoxy-Modified Latex, Interior, matching topcoat.
c. Topcoat: Epoxy-Modified Latex, Interior, semi-gloss (MPI Gloss Level 5), MPI #215.

1) Basis of Design: Sherwin Williams; Pro Industrial Waterbased Catalyzed Epoxy B73-360 Series.

d. Topcoat: Epoxy-Modified Latex, Interior, gloss (MPI Gloss Level 6), MPI #115.

1) Basis of Design: Sherwin Williams; Pro Industrial Waterbased Catalyzed Epoxy B73-300 Series.

e. Gloss and Sheen: As scheduled or as indicated in Design Selections.

D. CMU Substrates:

1. High-Performance Architectural Latex System: MPI INT 4.2D.

a. Prime Coat: Interior/exterior latex block filler, MPI #4.

1) Basis of Design: Sherwin Williams; Pro Industrial Heavy Duty Block FillerB42W150.

b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-Shel B41-1900 Series.

d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections

2. Institutional Low-Odor/VOC Latex System: MPI INT 4.2E.
   a. Prime Coat: Interior/exterior latex block filler, MPI #4.
      1) Basis of Design: Sherwin Williams; Pro Industrial Heavy Duty Block Filler B42W150.
   b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
   c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.
      1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Flat B30-2900.
   d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), MPI #144.
      1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-shel B41-1900 Series.
   e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.
      1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.
   f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.
      1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.
   g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.
      1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.
   h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.
      1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Gloss B66-600 Series.
   i. Gloss and Sheen: As scheduled or as indicated in Design Selections.
3. Water-Based Epoxy Coating System: MPI INT 4.2J.
   a. Prime Coat: Interior/exterior latex block filler, MPI #4.
      1) Basis of Design: Sherwin Williams; Pro Industrial Heavy Duty Block Filler B42W150.
   b. Intermediate Coat: Epoxy-Modified Latex, Interior, matching topcoat.
   c. Topcoat: Epoxy-Modified Latex, Interior, semi-gloss (MPI Gloss Level 5), MPI #215.
      1) Basis of Design: Sherwin Williams; Pro Industrial Waterbased Catalyzed Epoxy B73-360 Series.
   d. Topcoat: Epoxy-Modified Latex, Interior, gloss (MPI Gloss Level 6), MPI #115.
      1) Basis of Design: Sherwin Williams; Pro Industrial Waterbased Catalyzed Epoxy B73-300 Series.
   e. Gloss and Sheen: As scheduled or as indicated in Design Selections.

E. Steel Substrates:

1. Water-Based Dry-Fall System: MPI INT 5.1C.

a. Prime Coat: Quick-drying alkyd metal primer (shop primed, MPI #76.

1) Basis of Design: Sherwin Williams; Pro Industrial Kem Bond HS B50WZ4.

b. Topcoat: Dry fall, latex, flat, MPI #118.

1) Basis of Design: Sherwin Williams; Pro Industrial Waterborne Acrylic Dryfall Low Gloss Eg-shel B41-1100 Series..

c. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1), MPI #133.

1) Basis of Design: Sherwin Williams; Pro Industrial Multi-Surface Acrylic Matte B66-1570 Series.

d. Topcoat: Dry fall, latex (MPI Gloss Level 3), MPI #155.

1) Basis of Design: Sherwin Williams; Pro Industrial Waterborne Acrylic Dryfall Eg-shel B42W182 Series..

e. Topcoat: Dry fall, latex (MPI Gloss Level 5), MPI #226.

1) Basis of Design: Sherwin Williams; Pro Industrial Waterborne Acrylic Dryfall Semi-gloss B42W83. .

f. Gloss and Sheen: As scheduled or as indicated in Design Selections.

2. High-Performance Architectural Latex System: MPI INT 5.1R.

a. Prime Coat: Quick-drying alkyd metal primer (shop primed), MPI #76.

1) Basis of Design: Sherwin Williams; Pro Industrial Kem Bond HS B50WZ4.

b. Intermediate Coat: High-performance architectural latex matching topcoat.

c. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

d. Gloss and Sheen: As scheduled or as indicated in Design Selections.

3. Institutional Low-Odor/VOC Latex System: MPI INT 5.1S.

a. Prime Coat: Rust-inhibitive primer (water based), MPI #107.

1) Basis of Design: Sherwin Williams; Pro Ind Pro-Cryl Primer B66-1300 Series.

b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

d. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Gloss B66-600 Series.

e. Gloss and Sheen: As scheduled or as indicated in Design Selections.

4. High-Heat-Resistant Coating System: MPI INT 5.2D.

a. Prime Coat: Primer recommended in writing for use in coating system and under conditions indicated by manufacturer of topcoat.
b. Top Coat(s): Aluminum paint, high heat, (MPI #22).

1) Basis of Design: Sherwin Williams; Heat Flex Hi-Temp Aluminum B58SX820.
2) Provide number of topcoats recommended in writing for use in coating system and under conditions indicated by manufacturer but not less than two.

F. Galvanized-Metal Substrates:

1. Water-Based Dry-Fall System: MPI INT 5.3H.

a. Prime Coat: Dry fall, water based, for galvanized steel, matching topcoat.
b. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1), MPI #133.

1) Basis of Design: Sherwin Williams; Pro Industrial Multi-Surface Acrylic Matte B66-1570 Series.

c. Gloss and Sheen: As scheduled or as indicated in Design Selections.

2. High-Performance Architectural Latex System: MPI INT 5.3M.

a. Prime Coat: Waterborne galvanized-metal primer, MPI #134.

1) Basis of Design: Sherwin Williams; Pro Ind Pro-Cryl Primer B66-1300 Series.

b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

d. Gloss and Sheen: As scheduled or as indicated in Design Selections.

3. Institutional Low-Odor/VOC Latex System: MPI INT 5.3N.

a. Prime Coat: Waterborne galvanized-metal primer, MPI #134.

1) Basis of Design: Sherwin Williams; Pro Ind Pro-Cryl Primer B66-1300 Series.

b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

d. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Gloss B66-600 Series.

e. Gloss and Sheen: As scheduled or as indicated in Design Selections.

G. Dressed Lumber Substrates: Including architectural woodwork, doors.

1. High-Performance Architectural Latex System: MPI INT 6.3A.

a. Prime Coat: Interior latex-based wood primer, MPI #39.

1) Basis of Design: Sherwin Williams; Pro Block Premium B51W620.

b. Intermediate Coat: High-performance architectural latex matching topcoat.

c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-Shel B41-1900 Series.

d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

2. Institutional Low-Odor/VOC Latex System: MPI INT 6.3V.

a. Prime Coat: Interior latex-based wood primer, MPI #39.

1) Basis of Design: Sherwin Williams; Pro Block Premium B51W620.

b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Flat B30-2900.

d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), MPI #144.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-shel B41-1900 Series.

e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Gloss B66-600 Series.

i. Gloss and Sheen: As scheduled or as indicated in Design Selections.

H. Wood Panel Substrates: Including painted plywood, medium-density fiberboard, hardboard.

1. High-Performance Architectural Latex System: MPI INT 6.4S.

a. Prime Coat: Interior latex-based wood primer, MPI #39.

1) Basis of Design: Sherwin Williams; Pro Block Premium B51W620.

b. Intermediate Coat: High-performance architectural latex matching topcoat.

c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-Shel B41-1900 Series.

d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

2. Institutional Low-Odor/VOC Latex System: MPI INT 6.4T.

a. Prime Coat: Interior latex-based wood primer, MPI #39.

1) Basis of Design: Sherwin Williams; Pro Block Premium B51W620.

b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Flat B30-2900.

d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), MPI #144.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-shel B41-1900 Series.

e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Gloss B66-600 Series.

i. Gloss and Sheen: As scheduled or as indicated in Design Selections.

I. Plastic Substrates:

1. High-Performance Architectural Latex System MPI INT 6.8A:

a. Prime Coat: Primer, bonding, water based, MPI #17.

1) Basis of Design: Sherwin Williams; Extreme Bond Primer B51W1150.

b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-Shel B41-1900 Series.

d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

2. Institutional Low-Odor/VOC Latex System MPI INT 6.8F:

   a. Prime Coat: Primer, bonding, water based, MPI #17.

      1) Basis of Design: Sherwin Williams; Extreme Bond Primer B51W1150.

   b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
   c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

      1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Flat B30-2900.

   d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2, MPI #144.

      1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-shel B41-1900 Series.

   e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

      1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

   f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.

      1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

   g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

      1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

   h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

      1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Gloss B66-600 Series.

J. Gypsum Board and Plaster (Gypsum and Portland Cement) Substrates:

   1. High-Performance Architectural Latex System: MPI INT 9.2B.

      a. Prime Coat: Interior latex primer/sealer, MPI #50.

         1) Basis of Design: Sherwin Williams; ProMar 200 0 VOC Primer B28W2600.

      b. Intermediate Coat: High-performance architectural latex matching topcoat.
      c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.

         1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-shel B41-1900 Series.

      d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

         1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

      e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

2. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.

a. Prime Coat: Institutional low-odor/VOC primer/sealer, MPI 149.

1) Basis of Design: Sherwin Williams; ProMar 200 0 VOC Primer B28W2600.

b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Flat B30-2900.

d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), MPI #144.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-shel B41-1900 Series.

e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Gloss B66-600 Series.

i. Gloss and Sheen: As scheduled or as indicated in Design Selections.

3. Water-Based Epoxy Coating System: MPI INT 9.2F.

a. Prime Coat: Interior latex primer/sealer, MPI #50.

1) Basis of Design: Sherwin Williams; ProMar 200 0 VOC Primer B28W2600.

b. Intermediate Coat: Epoxy-Modified Latex, Interior, matching topcoat.
c. Topcoat: Epoxy-Modified Latex, Interior, semi-gloss (MPI Gloss Level 5), MPI #215.

1) Basis of Design: Sherwin Williams; Pro Industrial Waterbased Catalyzed Epoxy B73-360 Series.

d. Topcoat: Epoxy-Modified Latex, Interior, gloss (MPI Gloss Level 6), MPI #115.

1) Basis of Design: Sherwin Williams; Pro Industrial Waterbased Catalyzed Epoxy B73-300 Series.

e. Gloss and Sheen: As scheduled or as indicated in Design Selections.

K. Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.

1. Latex System: MPI INT 10.1A.

a. Prime Coat: Interior latex primer/sealer, MPI #50.

1) Basis of Design: Sherwin Williams; ProMar 200 0 VOC Primer B28W2600.

b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Flat B30-1900 Series.

d. Topcoat: Latex, interior (MPI Gloss Level 2), MPI #44.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-shel B41-1900 Series.

e. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

f. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

1) Basis of Design: Sherwin Williams; ProMar 200 0 VOC Gloss B21-12600 Series.

h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), MPI #114.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic B66-600 Series.

i. Gloss and Sheen: As scheduled or as indicated in Design Selections.

2. Institutional Low-Odor/VOC Latex System: MPI INT 10.1D.

a. Prime Coat: Institutional low-odor/VOC primer/sealer, MPI #50.

1) Basis of Design: Sherwin Williams; ProMar 200 0 VOC Primer B28W2600.

b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Flat B30-2900.

d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), MPI #144.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Low Gloss Eg-shel B41-1900 Series.

e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Eg-shel B20-1900 Series.

f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.

1) Basis of Design: Sherwin Williams; ProMar 200 HP 0 VOC Semi-gloss B31-1900 Series.

g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Semi-gloss B66-650 Series.

h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.

1) Basis of Design: Sherwin Williams; Pro Industrial Acrylic Gloss B66-600 Series.

i. Gloss and Sheen: As scheduled or as indicated in Design Selections.

3.12 INTERIOR TRANSPARENT FINISH WOODWORK SCHEDULE

A. Stained Woodwork: Provide the following stained finishes over new interior woodwork:

1. Water-Based Varnish over Stain System: MPI INT 6.3W and MPI INT 6.4U

a. Stain Coat: Stain, semi-transparent, for interior wood, MPI #90.

1) Basis of Design: Sherwin Williams; Minwax Performance Series Tintable Interior Wood Stain 250 VOC.

b. First Intermediate Coat: Water-based varnish matching topcoat.
c. Second Intermediate Coat: Water-based varnish matching topcoat.
d. Topcoat: Varnish, water based, clear, satin (MPI Gloss Level 4), MPI #128.

1) Basis of Design: Sherwin Williams; Minwax Polycrylic Protective Finish Satin.

e. Topcoat: Varnish, water based, clear, semi-gloss (MPI Gloss Level 5), MPI #129.

1) Basis of Design: Sherwin Williams; Minwax Polycrylic Protective Finish Semi-Gloss.

f. Topcoat: Varnish, water based, clear, gloss (MPI Gloss Level 6), MPI #130.

1) Basis of Design: Sherwin Williams; Minwax Polycrylic Protective Finish Gloss.

B. Natural-Finish Woodwork: Provide the following natural finishes over new interior woodwork:

1. Water-Based Varnish System: MPI INT 6.3Q and MPI INT 6.4M

a. Prime Coat: Water-based varnish matching topcoat.
b. Intermediate Coat: Water-based varnish matching topcoat.
c. Topcoat: Varnish, water based, clear, satin (MPI Gloss Level 4), MPI #128.

1) Basis of Design: Sherwin Williams; Minwax Polycrylic Protective Finish Satin.

d. Topcoat: Varnish, water based, clear, semi-gloss (MPI Gloss Level 5), MPI #129.

1) Basis of Design: Sherwin Williams; Minwax Polycrylic Protective Finish Semi-Gloss.

e. Topcoat: Varnish, water based, clear, gloss (MPI Gloss Level 6), MPI #130.

1) Basis of Design: Sherwin Williams; Minwax Polycrylic Protective Finish Gloss.

3.13 PAINTING FINISH SCHEDULE

A. Exterior Paint Colors

1. PT01:

a. Manufacturer:
b. Number:
c. Sheen:
d. Texture:
e. Color:

B. Color and Gloss: Match sample accepted by Architect.

C. Interior Paint Colors

1. PT101:

a. Manufacturer:
b. Number:
c. Sheen:
d. Texture:
e. Color:

2. IPT01:

a. Manufacturer:
b. Number:
c. Sheen:
d. Texture:
e. Color:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 099600
HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of high-performance coating systems and supplementary items to complete the work.

1. Applications include:

a. Surface preparation.
b. Prime coat at slip critical connections.
c. Prime coat, intermediate coat (if applicable) and finish coats.

2. Substrates include:

a. Concrete and GFRC.
b. Steel.
c. Galvanized metal.
d. Aluminum (not anodized or otherwise coated).

3. Submit the following with Bid / Proposal:

a. Copy of Warranty to be provided to Owner at completion of work.
b. Certification that primer provides Class B Slip Coefficient.
c. Certification that coating applicator has the following qualifications:

1) American Institute of Steel Construction (AISC) and Society for Protective Coatings (SSPC) Joint Standard for Shop Application of Complex Protective Coating Systems.
2) Society for Protective Coatings (SSPC) SSPC-QP3 for shop application SSPC-QP1 for field application of coatings.

B. Related Section: Division 09 Section "Painting" for exterior and interior painting not specified in this Section.

1.2 DEFINITIONS

A. DFT: Dry film thickness.

B. Gloss Level 5 (Semigloss): 35 to 70 units at 60 degrees, according to ASTM D 523.

C. FEVE: Fluoropolymer coating containing 100% fluorinated ethylene vinyl ether (FEVE) resin.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, preparation requirements, finishes, construction details, installation instructions, and recommendations for maintenance

B. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 in (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1. Manufacturer shall certify all products comply with Federal, State and Local regulatory requirements including but not limited to OTC and VOC regulations. Notify Architect of materials not in compliance.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

C. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Materials: Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Not less than five (5) gallons, in one gallon cans, of each material and color applied.
2. Quantity: Not less than fifty (50) gallons, in one gallon cans, of each material and color applied.
3. Containers to be tightly sealed.
4. Label each container with color, color number, texture and locations, in addition to manufacturer's label.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Certification that coating applicator has the following qualifications:

a. American Institute of Steel Construction (AISC) and Society for Protective Coatings (SSPC) Joint Standard for Shop Application of Complex Protective Coating Systems.
b. Society for Protective Coatings (SSPC) SSPC-QP3 for shop application SSPC-QP1 for field application of coatings.

C. Field Mockups: Apply benchmark samples of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface and one plate with several bolted connections to represent surfaces and conditions for application of each coating. Demonstrate field applied coating procedures for the following:

   a. Bolted connections.
   b. Damaged areas.

2. Final approval of field applied coatings will be from field mock-up.
3. Clean exposed faces of mock-up.
4. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
5. Demonstrate the proposed range of aesthetic effects and workmanship.

   a. Provide required color and sheen on each surface.

6. Protect approved mock-up from the elements with weather-resistant membrane.
7. Obtain Architect's approval of mockups before starting installation.
8. Maintain mockups during construction in an undisturbed condition as a standard for review of the completed Work.
9. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and approved by Architect in writing.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

   a. Architect.
   b. Contractor, including superintendent.
   c. Installer, including project manager and supervisor.
   d. If requested, Manufacturer's qualified technical representative.
   e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review inspection and testing requirements.
   e. Review environmental conditions and procedures for coping with unfavorable conditions.
   f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.9 PROJECT CONDITIONS

A. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are above 45 deg. F (7 deg. C), unless otherwise permitted by manufacturer's printed instructions or written authorization from the coatings manufacturer.

B. Do not apply coatings in snow, rain, fog or mist, or when the relative humidity exceeds 85 percent, or at temperatures less than 5 deg. F (-15 deg. C) above the dew point, or to damp or wet surfaces unless otherwise permitted by manufacturer's printed instructions or written authorization from the coatings manufacturer. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

A. Coating Manufacturer Warranty: Submit coating manufacturer’s written warranty signed by manufacturer, agreeing to repair or replace work which exhibits material defects caused by error in formulation, manufacture or design of product. "Defects" is defined to include, but is not limited to, peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.

1. Warranty Period - Polyurethane System: Manufacturer shall warrant the products to be free from material Defects for a period of 5 years from date of Substantial Completion
2. Warranty Period - Polysiloxane System: Manufacturer shall warrant the products to be free from material Defects for a period of 10 years from date of Substantial Completion
3. Warranty Period - FEVE System: Manufacturer shall warrant the products to be free from material Defects for a period of 15 years from date of Substantial Completion

a. Adhesion: No loss of adhesion as evidenced by chipping, cracking or peeling.
b. Color Retention: Fading and color change shall not exceed Delta E of 5 Hunter Units per ASTM D 2244 measured on exposed surfaces and compared to unexposed surfaces or control samples. Fading and color change may not be uniform; however, the total change shall not exceed the value indicated.
c. Inspections: Warranty includes annual inspections by Manufacturer NACE Certified Inspector.

B. Coatings Installer Warranty: Submit coating installer written warranty signed by installer, agreeing to repair or replace work which exhibits workmanship defects. "Defects" is defined to include, but is not limited to, peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.

1. Warranty Period: Applicator shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers/fabricators

listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers/fabricators offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Colors and Gloss: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide primer material produced by the same manufacturer as the finish coats. Use only thinners recommended by the manufacturer, and only within recommended limits. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
3. Provide products of same manufacturer for each coat in a coating system.

C. Regulatory Requirements: Comply with federal, state, and local codes and regulations applicable to surface preparation, coating application, storage, handling, and environmental requirements, including Federal, State and Local EPA requirements for maximum VOC.

D. Coatings Content:

1. Zinc dust pigment used in zinc rich coatings shall conform to the requirements of ASTM D520-00, Type II.
2. Coatings shall be free of zinc-chromate or strontium chromate.
3. Coatings shall be free of mercury.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Coatings shall comply with the following minimum performance requirements.

a. Physical Test Result - ASTM B117 Salt Spray (Fog): No blistering, cracking, softening, or delamination of film after 2000 hours. Minimal or no rust creepage at the scribe.

2.4 PRIMERS

A. Primer for Concrete/GFRC to receive Polyurethane or Polysiloxane Topcoat:

1. Epoxy, High Build: Provide factory formulated polyamide epoxy primer compatible with substrate and topcoat indicated.
2. Manufacturers and Products:

a. PPG; Amerlock 400.
b. Carboline; No. 893.
c. Sherwin-Williams; Macropoxy 646-100, B58-620 Series.
d. TNEMEC; Series 66-HS Hi-Build Epoxoline.

B. Primer for Steel to receive Polyurethane or Polysiloxane Topcoat:

1. Epoxy Zinc Rich:. Provide factory formulated prime coat material compatible with the substrate and finish coats indicated. Primer shall be a polyamide or amine cured epoxy zinc-rich coating containing metallic (active) zinc content in the dried film > 81% by weight. Coating shall be capable of film build in a single coat. Product must qualify per AISC Specification for Structural Joints using ASTM A325 or A490 Bolts RCSC Specification for Structural Joints Table 3, Class B. Primers shall be lead hazard free.
2. Manufacturers and Products:

a. PPG; Amercoat 68HS (4.0 - 5.0 mils DFT).
b. Carboline; Carbozinc. 859 (4.0 - 5.0 mils DFT).
c. Sherwin-Williams; Zinc Clad 4100 (4.0 - 5.0 mils DFT).
d. TNEMEC; Series 90-97 Tnemec Zinc (4.0 - 5.0 mils DFT).

C. Primer for Galvanized Metal to receive Polyurethane or Polysiloxane Topcoat:

1. Wash Primer:

a. Manufacturer and Product:

1) Sherwin-Williams; DTM Wash Primer (0.7 - 1.3 mils DFT).
2) Carboline; Galoseal WB (0.5 - 1.0 mils DFT).
3) TNEMEC; Series 115 Uni-Bond (2.0 - 4.0 mils DFT).

D. Primer for Aluminum to receive Polyurethane or Polysiloxane Topcoat:

1. Epoxy, High Build. Provide factory formulated polyamide epoxy primer compatible with substrate and topcoat indicated.
2. Manufacturers and Products:

a. PPG Ameron; Amerlock 400.
b. Carboline; No. 893.
c. Sherwin-Williams; Macropoxy 646-100, B58-620 Series..
d. TNEMEC; Series 66-HS Hi-Build Epoxoline.

E. Primer for Steel to receive FEVE Topcoat:

1. Zinc Rich:

a. Manufacturers and Products:

1) PPG Ameron; Dimetcote 21-5, Inorganic Zinc Rich Primer (3.0 - 4.0 Mils DFT).
2) Sherwin-Williams; Zinc Clad 4100 (4.0 - 5.0 mils DFT).

F. Primer for Galvanized Metal and Aluminum to receive FEVE Topcoat:

1. Wash Primer:
2. Manufacturers and Products:

a. PPG; Coraflon ADS, Wash Primer ADS225/ADS226 (0.3 - 0.5 Mils DFT).
b. Sherwin-Williams; DTM Wash Primer (0.7 - 1.3 Mils DFT).

G. Fire Resistive Materials: Unless indicated otherwise, do not prime structural steel surfaces to receive sprayed-on fire resistive materials.

2.5 INTERMEDIATE COATING FOR FEVE TOPCOAT

A. Intermediate Coating for Steel, Galvanized Metal, and Aluminum to receive FEVE Topcoat:

1. Epoxy:

a. Manufacturers and Products:

1) PPG; Coraflon ADS, Epoxy Primer ADS553/ADS554 (3.0 - 4.0 Mils DFT).

2. Aliphatic Polyurethane:

a. Manufacturers and Products:

1) Sherwin-Williams; Hi-Solids Polyurethane 250, B65-300 Series (3.0 - 5.0 Mils DFT)

2.6 POLYURETHANE TOPCOAT

A. Polyurethane, Two Component, Pigmented: Provide factory formulated high-build aliphatic acrylic polyurethane compatible with prime coat indicated. Coating shall be capable of film build in a single coat. Coating shall not contain alkyd resins.

1. Manufacturers and Products:

a. PPG; Amershield (4.0 - 7.0 mils DFT).
b. Carboline; Carbothane 134 HB (4.0 - 5.0 mils DFT).
c. Sherwin-Williams; Hi-Solids Polyurethane 250, B65-300 Series (3.0 - 5.0 Mils DFT).
d. TNEMEC; Series 1094 Endura Shield (4.0 - 5.0 mils DFT).

2.7 POLYSILOXANE TOPCOAT

A. Polysiloxane, Pigmented: Provide factory formulated high-build epoxy polysiloxane compatible with prime coat indicated. Coating shall display weathering characteristics superior to that of high performance polyurethane. Coating shall be capable of film build in a single coat.

1. Manufacturers and Products:

a. PPG; PSX 700 (5.0 - 7.0 mils DFT).
b. Carboline; Carboxane 2000 (5.0 - 7.0 mils DFT).
c. Sherwin Williams; Sher-Loxane 800 (5.0 - 7.0 mils DFT).
d. TNEMEC; Series 740 UVX (5.0 - 7.0 mils DFT).

2.8 FEVE TOPCOAT

A. Air Dried Fluoropolymer, Pigmented:

1. Acceptable Manufacturers and Products:

a. PPG; Coraflon ADS, Color Coat (1.5 - 2.0 Mils DFT).
b. Sherwin-Williams; Fluorokem HS-100 (2.5 - 3.0 Mils DFT).

B. Air Dried Fluoropolymer, Clear:

1. Basis of Design Manufacturers and Products:

a. PPG; Coraflon ADS Clear Coat for ADS Metallic and Bright Color Coatings (1.5 - 2.0 Mils DFT).

2.9 REPAIR COATINGS

A. Repair Epoxy: Provide factory formulated repair epoxy. Material shall be compatible with direct to metal application and other coatings in the system being repaired. Coating shall be capable of film build in a single coat.

1. Manufacturers and Products:

a. PPG; Amerlock 400/2 or Amercoat 370 (5.0 - 7.0 mils DFT).
b. Carboline; Carbomastic 15 Series (5.0 - 7.0 mils DFT).
c. Sherwin-Williams; Macropoxy 646-100, B58-620 Series. (5.0 - 7.0 mils DFT).
d. TNEMEC; Series 66HS Epoxoline (5.0 - 7.0 mils DFT).

B. Zinc Phosphate Coating for Galvanized Metals:

1. Basis of Design Manufacturer and Product:

a. Henkel Surface Technologies; Bonderite M-ZN 5.

2.10 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner may engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove non-complying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Maximum Moisture Content of Concrete Substrates: When measured with an electronic moisture meter as follows:

a. Concrete: 12 percent.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator’s written installation instructions.
2. Accepted submittals.

3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete/GFRC Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

1. Abrasive blast clean surfaces to comply with SSPC-SP-13, ICRI 310.2R CSP 2-4 Surface Preparation of Concrete.

E. Steel Substrates: Surfaces to be coated must be free of any and all contaminants prior to application of protective coatings. Clean non-galvanized, ferrous metal surfaces, that have not been shop-coated; remove oil, grease, dirt, loose mill scale and other foreign substances. Use solvent or mechanical cleaning methods that comply with the recommendations of the Steel Structures Painting Council.

1. Shop-Applied Coatings:

a. Clean surfaces to remove grease and oil and other contaminants per SSPC-SP-1, Solvent Cleaning, or other methods recommended by coatings manufacturer.
b. Abrasive blast in accordance with SSPC. Refer to coating manufacturer application instructions for the required surface profile and other related information. If the surface profile is deeper than indicated on manufacturer application / product data sheet an increase in the primer dry film thickness must be made prior to applying topcoat. Applying additional topcoat to make up for deficiencies in the specified dry film thickness of the primer is not permitted.

1) Inorganic Zinc Primers: SSPC-SP-10, Near White Metal Blast Cleaning.
2) Organic Zinc Primers: SSPC-SP-6, Commercial Metal Blast Cleaning.

c. Abrasive materials used during surface preparation operations must be free of contaminants and suitable to produce the desired surface profile required by the coating manufacturer.
d. Apply zinc primer to all surfaces including filler plates, slip critical and bearing connections unless indicated otherwise. Allow primer to cure, then mask slip critical and bearing connection areas prior to application of topcoat.
e. All applied coatings shall be free of runs, sags, drops, ridges, waves, laps, bubbles, embedded foreign matter, and other indications of improper application.

2. Touch-Up Procedures:

a. If epoxy zinc-rich metal primer is damaged or compromised, follow preparation procedures and apply spot repair coat of repair epoxy prior to topcoat application. Do not use repair epoxy on slip critical connection areas.
b. If galvanizing is damaged or compromised, follow preparation procedures and apply spot repair coat of repair epoxy prior to topcoat application. Do not use repair epoxy on slip critical connection areas.
c. Coating bolted connections:
    1) Clean faying surfaces per SSPC SP 1, Solvent Cleaning to remove any contaminants.
    2) Clean bolts and surrounding area to be coated per SSPC SP 1 using alkaline cleaner such as Amercoat 88 or solvent such as Ameron Amerase or Carboline Surface Cleaner No.3. Use SSPC SP 2, or SSPC SP 3, to remove any rust or other hard contaminants.
    3) Use SSPC SP 2, or SSPC SP 3, to "feather" any hard edges existing on the topcoat portion of painted members where it abuts the faying surface.
    4) Prime bolts with repair epoxy.
    5) Coat connection with topcoat exercising care to "square off" tie-in areas to minimize the difference in appearance between the existing topcoat and touch-up areas. Spray application is preferred.
d. Repairing damaged areas:
    1) Clean damaged area per SSPC SP 1, Solvent Cleaning to remove any contaminants.
    2) Use SSPC SP 11, to remove rust at exposed steel surfaces.
    3) Use SSPC SP 2, or SSPC SP 3, to remove any loose paint and other detrimental foreign matter.
    4) Feather any hard edges existing on the topcoat portion of painted members where it abuts the damaged area.
    5) Apply repair epoxy allowing an overlap on surrounding intact topcoat.
    6) Coat damaged area with topcoat exercising care to "square off" tie-in areas to minimize the difference in appearance between the existing topcoat and touch-up areas. Spray application is preferred.

F. Galvanized Steel Substrates: Clean surfaces to be coated to remove all contaminants prior to application of protective coatings. Apply topcoat system directly over the galvanized metal after the following surface preparation:
    1. Clean surfaces to remove grease and oil and other contaminants per SSPC-SP-1, Solvent Cleaning.
    2. Prepare surface per SSPC-SP-16, Brush Off Blast Cleaning of Galvanized Steel, Stainless Steel or Non-Ferrous Metal.
        a. Alternate methods of surface preparation, including wash primer or zinc phosphating treatment may be used when recommended in writing by the coatings manufacturer and approved by the Architect.

G. Aluminum Substrates: Clean surfaces to be coated to remove all contaminants prior to application of protective coatings.

3.4 MATERIAL PREPARATION

A. Material Preparation: Carefully mix and prepare materials in compliance with the coating manufacturer's Application Instructions using a professional mixing tool such as "Jiffy Mixer".

B. Thin only for workability with approved thinners and in accordance with coatings manufacturer's application instructions.

3.5 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions.

1. Use applicators and techniques suited for coating and substrate indicated.
2. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
3. Minimum Coating Thickness: Apply each material to provide not less than the minimum DFT recommended by the coating manufacturer. Provide total DFT for the entire system as recommended by the coating manufacturer.
4. Mechanical Application: Use mechanical methods for coating application when permitted by the manufacturer's recommendations. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of 2 coats in one pass, unless recommended otherwise by the manufacturer.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

E. Primer: Shop apply prime coat as recommended by the manufacturer, to material required to be coated or finished.

F. Intermediate Coat: Shop-apply intermediate coat within 30 days or as recommended by manufacturer.

1. Prior to application of intermediate coat, primer shall be power-washed; or light brush-off blasted to remove all loose dirt and foreign contaminants as recommended by the manufacturer.
2. If 30 day re-coat window of primer is exceeded, perform surface preparation as recommended by the manufacturer in addition to or in conjunction with power-wash cleaning.

G. Topcoats: Shop-apply topcoat as recommended by the manufacturer. Apply topcoats within re-coat window as recommended by manufacturer. Remove, refinish or re-coat work not in compliance with specified requirements

H. Topcoats: Field-apply topcoat as recommended by the manufacturer. Apply topcoats within re-coat window as recommended by manufacturer. Remove, refinish or re-coat work not in compliance with specified requirements

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Fabricator/applicator shall allow Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure

installation is proceeding in accordance with manufacturer/fabricator's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
2. Paint Manufacturer's Representative shall inspect and certify that surfaces are acceptable to receive coating system.
3. Installer/Applicator shall certify that materials and installation are in accordance with Manufacturer's requirements and Contract Documents.

B. Owner Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense.

1. Testing agency will perform tests for compliance with specified requirements.

a. Perform daily visual shop inspection of surface preparation prior to primer application.
b. Perform shop and field testing of DFT for each coat; not less than 1% of materials to be coated.
c. Perform visual inspection after final coating application.
d. Shop and field painting inspections shall be in accordance with ASTM 3276 Standard Guide for Painting Inspectors.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.8 HIGH-PERFORMANCE COATING SCHEDULE

A. Provide the following coating systems for substrates indicated. Apply additional coats when undercoats or other conditions show through the final coat, until the cured coating system film is of uniform coating finish, color and appearance.

B. Concrete and GFRC Substrates:

1. Polyurethane over High Build Epoxy Primer System:

a. Prime Coat: Epoxy, high-build.
b. Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 5).

2. Polysiloxane over High Build Epoxy Primer System:

a. Prime Coat: Epoxy, high-build.
b. Topcoat: Polysiloxane, pigmented, gloss (Gloss Level 5).

C. Steel Substrates:

1. Polyurethane over Zinc Rich Epoxy Primer System:

a. Prime Coat: Epoxy, zinc-rich.
b. Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 5).

2. Polysiloxane over Zinc Rich Epoxy Primer System:

a. Prime Coat: Epoxy, zinc-rich.
b. Topcoat: Polysiloxane, pigmented, gloss (Gloss Level 5).

3. FEVE (Fluoropolymer) over Zinc Rich Primer System:

a. Prime Coat: Zinc rich.
b. Intermediate Coat: Epoxy or Aliphatic polyurethane.
c. First Topcoat: Air dried fluoropolymer, pigmented.
d. Second Topcoat for Metallic and Bright Colors: Air dried fluoropolymer, clear.

D. Galvanized-Metal Substrates:

1. Polyurethane over Galvanized Metal:

a. Prime Coat: SSPC-SP-16, or when recommended by coatings manufacturer, wash primer or zinc phosphating.
b. Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 5).

2. Polysiloxane over Galvanized Metal:

a. Prime Coat: SSPC-SP-16, or when recommended by coatings manufacturer, wash primer or zinc phosphating.
b. Topcoat: Polysiloxane, pigmented, gloss (Gloss Level 5).

3. FEVE (Fluoropolymer) over Galvanized Metal:

a. Prime Coat: SSPC-SP-16, or when recommended by coatings manufacturer, wash primer or zinc phosphating.
b. Intermediate Coat: Epoxy or Aliphatic polyurethane.
c. First Topcoat: Air dried fluoropolymer, pigmented.
d. Second Topcoat for Metallic and Bright Colors: Air dried fluoropolymer, clear.

E. Aluminum (Not Anodized or otherwise Coated) Substrates:

1. Polyurethane System over High Build Epoxy Primer System:

a. Prime Coat: Epoxy, high-build.

b. Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 5).

2. Polysiloxane System over High Build Epoxy Primer System:

a. Prime Coat: Epoxy, high-build.
b. Topcoat: Polysiloxane, pigmented, gloss (Gloss Level 5).

3. FEVE (Fluoropolymer) over Wash Primer System:

a. Prime Coat: Wash primer.
b. Intermediate Coat: Epoxy or Aliphatic polyurethane.
c. First Topcoat: Air dried fluoropolymer, pigmented.
d. Second Topcoat for Metallic and Bright Colors: Air dried fluoropolymer, clear.

3.9 HIGH-PERFORMANCE COATINGS COLOR SCHEDULE

A. Color and Gloss: Match sample approved by Architect.

B. Color and Gloss:

1. Manufacturer:
2. Number:
3. Sheen:
4. Texture:
5. Color:

C. HPC01:

1. Manufacturer:
2. Number:
3. Sheen:
4. Texture:
5. Color:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 101100
VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work for this section includes visual display surfaces and supplementary items necessary to complete their installation for the following:

1. Metal-framed markerboards.
2. Metal-framed tackboards.
3. Glass markerboards.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: For each type of visual display unit indicated.

1. Visual Display Panel: Not less than 8-1/2 by 11 in (215 by 275 mm), with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6 in (150 mm) long sections of each trim profile.
3. Display Rail: 6 in (150 mm) long section of each type.
4. Accessories: Full-size Sample of each type of accessory.

D. Product Schedule: For visual display boards. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display units to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Fire-Test-Response Characteristics for Vinyl-Fabric-Faced Tackboards: Provide vinyl-fabric-faced tackboards with the following surface-burning characteristics as determined by testing assembled materials composed of facings and backings identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify vinyl-fabric-faced tackboards with appropriate markings of applicable testing and inspecting agency.

1. Flame Spread: 25 or less (Class A).
2. Smoke Developed: 10 or less.

1.6 WARRANTY

A. Porcelain Enamel Warranty: Submit a written warranty executed by manufacturer agreeing to replace porcelain enamel boards that do not retain their original writing and erasing qualities, exhibit excessive fading of color, or exhibit crazing, cracking, or flaking for the lifetime of the original installation, provided the manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. ADP Lemco, Inc.
2. Best-Rite Manufacturing.
3. Claridge Products and Equipment, Inc.
4. Ghent Manufacturing, Inc.
5. Marsh Industries, Inc.; Visual Products Group.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MARKERBOARDS

A. Porcelain Enamel Panels: Balanced, high-pressure-laminated, porcelain enamel panels of 3-ply construction consisting of face sheet, core material, and backing.

1. Face Sheet: 0.024 in (0.61 mm) enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F (649 deg C).

a. Markerboard Cover Coat: Provide manufacturer's standard, light-colored, special writing surface with gloss finish intended for use with erasable dry markers.

2. Core: 3/8 in (10 mm) thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.
3. Backing Sheet: 0.015 in (0.38 mm) thick, aluminum-sheet backing.
4. Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.

2.4 TACKBOARDS

A. Natural-Cork Tackboards: Single-layer, 1/4 in (6 mm) thick, seamless, compressed fine-grain, bulletin board quality, natural-cork sheet; face sanded for natural finish.

B. Plastic-Impregnated Cork Tackboards: Seamless sheet, 1/4 in (6 mm) thick, ground natural cork compressed with a resinous binder with washable vinyl finish and integral color throughout, laminated to burlap backing.

1. Color: As scheduled or as indicated in Design Selections.

C. Vinyl-Fabric-Faced Tackboards: Mildew-resistant, washable vinyl fabric complying with FS CCC-W-408, Type II, weighing not less than 13 oz./sq. yd. (440 g/sq. m), laminated to 1/4 in (6 mm) thick cork sheet. Provide fabric with a flame-spread rating of 25 or less when tested according to ASTM E 84.

1. Color: As scheduled or as indicated in Design Selections.

D. Backing: Factory laminate cork face sheet under pressure to 1/4 in (6 mm) thick hardboard backing.

2.5 GLASS MARKERBOARDS

A. Glass Markerboards: 1/4 inch (6 mm) tempered glass markerboard, with smooth polished edge and eased corners.

1. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.
2. Mounting: Round, stainless-steel standoffs, holding glass approximately 1 inch (25 mm) from wall surface; mounted in notches in standoffs at top and bottom edges of markerboard.
3. Color and Surface: clear.
4. Marker Tray: Glass, supported by stainless-steel clips.
5. Sizes: as indicated on drawings.

2.6 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062 in (1.57 mm) thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure.

1. Where size of visual display surfaces or other conditions require support in addition to normal trim, provide structural supports or modify trim as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
2. Factory-Applied Trim: Manufacturer's standard narrow trim with no visible screws or exposed joints.
3. Chalktray: Manufacturer's standard, continuous, solid, extrusion-type, aluminum chalktray with ribbed section and smoothly curved exposed ends for each chalkboard.
4. Map Rail: Furnish map rail at top of each unit, complete with continuous cork display rail approximately 1 or 2 in (25 or 50 mm) wide, integral with map rail and end stops at each end of map rail.

2.7 FABRICATION

A. Porcelain Enamel Boards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.

B. Assembly: Provide factory-assembled units, unless field-assembled units are required.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
2. Provide manufacturer's standard vertical joint system between abutting sections of chalkboards.

2.8 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Aluminum Frame Finish: As scheduled or as indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Deliver factory-built visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Install units in locations and at mounting heights indicated and according to manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.5 CLEANING AND PROTECTION

A. Clean visual display boards according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display boards after installation and cleaning.

3.6 FINISH SCHEDULE

A. Plastic-Impregnated Cork Tackboards:

1. Color: As selected by Architect from manufacturer's standard colors and patterns.
2. Color: <INSERT COLOR>.

B. Vinyl-Fabric-Faced Tackboards:

1. Color: As selected by Architect from manufacturer's standard colors and patterns.
2. Color: <INSERT COLOR>.

C. Aluminum Frame Finish:

1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

a. Color: Light bronze.
b. Color: Medium bronze.
c. Color: Dark bronze.
d. Color: Black.
e. Color: As selected by Architect from the full range of industry colors and color densities.

3. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

a. Color: As selected by Architect from manufacturer's full range of colors.
b. Color: <INSERT COLOR>.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 101400
INTERIOR SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes code required signs, including ADA, and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, mounting heights, spacing, reinforcemnt, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Provide message list for each sign, including large-scale details of wording, lettering, and Braille layout.

C. Samples for Verification: For each type of sign, include the following Samples to verify color selected:

1. Panel Signs: Full-size Samples of each type of sign required.
2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter and number) required. Show character style, material, finish, and method of attachment.
3. Approved samples will not be returned for installation into Project.

1.3 QUALITY ASSURANCE

A. Manufacturer/Fabricator Qualifications: Manufacturer with experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Regulatory Requirements: Comply with code provisions as adopted by authorities having jurisdiction and with Americans with Disabilities Act (ADA) for the following:

1. Tactile and Braille Characters.
2. Typestyles.
3. Character Height.
4. Pictograms (Symbols).
5. Finish and Contrast.
6. Mounting Location and Height.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. ASI Sign Systems, Inc.
2. Best Manufacturing Company.
3. Mohawk Sign Systems.
4. Seton Identification Products
5. The Supersine Company.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MATERIALS

A. Plastic Laminate: Provide melamine plastic laminate engraving stock with face and core plies in contrasting colors.

B. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F.

1. Colored Coatings: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.
2. Mounting Fasteners: Use concealed fasteners fabricated from materials that are not corrosive to the sign material and mounting surface.

2.4 FABRICATION

A. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished with square coat edge condition and square corner condition.

B. Graphic Content and Style: Provide sign copy that complies with requirements indicated and ADA for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

C. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

D. Typical Sign Design:

E. Material: Cast-acrylic sheet or Plastic laminate.

F. Perimeter: Unframed.

G. Copy: Tactile and Braille.

H. Character Style: Helvetica.

I. Text: As indicated in the Sign Schedule to identify location.

J. Message: Fixed.

K. Sizes: Minimum required to meet code and ADA requirements.

L. Colors: As selected from manufacturer’s standard colors.

2.5 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
2. Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 in (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using one method indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Hook-and-Loop Tapes: Use hook-and-loop tapes to mount signs to smooth, nonporous surfaces.
3. Magnetic Tape: Use magnetic tape to mount signs to smooth, nonporous surfaces.
4. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use

double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.

3.5 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.6 SCHEDULE OF SIGNS

A. Stairs:

1. Provide a sign at each door to each stairway on each floor.
2. Message:

a. Required wording for exiting as required by the local code authorities. "**STAIR WAY**".
b. Braille message as required by ADA.

B. Stairs To Roof:

1. Provide a sign at each door on Level One to each stairway that goes to Roof.
2. Message: Required wording as required by the local code authorities. "**STAIRS GOES TO ROOF**".

C. Inside Stairs:

1. Provide a sign at each door in stairways.
2. Message: As required by local code authorities.

a. Identify stair location.
b. Identify floor level.
c. Identify all floors served.
d. Identify stairway's upper terminus.

3. Braille message as required by ADA.

D. Elevator Lobbies:

1. Provide a sign at each elevator group on other than Level One.
2. Provide a sign at each elevator group on all levels.

a. Message:

1) Required wording and diagram for exiting as required by the local code authorities.

"IN CASE OF FIRE
DO NOT USE ELEVATORS
USE STAIRS"

2) Graphic symbols that are appropriate, including Fire Evacuation Map.
3) Braille message as required by ADA.

b. Mount above elevator call button.

E. Toilet Rooms:

1. Provide a sign at the door to each public toilet room.
2. Message:

a. "**MEN**" or "**WOMEN**" as appropriate for the room.
b. Graphic symbol that is appropriate for the room.

c. Symbol of accessibity.
d. Braille message as required by ADA.

F. Other Rooms:

1. Provide a sign at each door that leads into the following rooms:
2. **TELEPHONE ROOM**
3. **ELECTRICAL ROOM**
4. **JANITOR CLOSET**
5. **MECHANICAL ROOM**
6. **MAIN TELEPHONE ROOM**
7. **MAIN ELECTRICAL ROOM**
8. **FIRE PUMP ROOM**
9. **FIRE CONTROL ROOM**
10. **SERVICE ELEVATOR**
11. **ELEVATOR MACHINE ROOM**
12. Braille message as required by ADA.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 102113
TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured toilet compartments and supplementary items necessary to complete work required for their installation.

1. Metal toilet compartments.
2. Stainless steel toilet compartments.
3. Plastic-laminate-clad toilet compartments.
4. Phenolic-core toilet compartments.
5. Solid-plastic (HDPE) toilet compartments.
6. Simulated stone (solid surfacing) toilet compartments.

B. Color Limitations and Burning Characteristics: When the manufacturer limits color selections for code compliant burning characteristics, the Contractor shall notify the Architect and provide code compliant products based on the Architect's color selection at no additional cost to the Owner.

C. Related Requirements:

1. Refer to Division 05 Section Metal Fabrications for supports that attach ceiling-anchored compartments to overhead structural system.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies

1. Include plans, elevations, sections, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
4. Show locations of centerlines of toilet fixtures.
5. Show locations of floor drains.
6. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.

C. Samples for Verification: Actual sample of finished product for each type of toilet compartment, hardware, and accessory.

1. Size: Manufacturers' standard size.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For toilet compartments.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate requirements for supports, blocking, reinforcing, and other supports concealed within walls or ceilings to ensure that toilet compartments can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Obtain toilet compartments from single source from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Surface-Burning Characteristics: Comply with ASTM E84 or NFPA 286; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials:

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. NFPA 286 Room-Corner Test: Pass.

C. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:

1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf (1112 N) applied at any direction and at any point, without deformation of panel.

D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with the building code and authorities having jurisdiction.

E. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "ADA Standards for Accessible Design" and ICC A117.1 for toilet compartments designated as accessible.

2.4 METAL TOILET COMPARTMENTS

A. Manufacturers:

1. Accurate Partitions Corporation.
2. All American Metal Corp.
3. American Sanitary Partition Corporation.
4. Ampco, Inc.
5. Bradley Corporation; Mills Partitions.
6. Flush Metal Partition Corp.
7. General Partitions Mfg. Corp.
8. Global Steel Products Corp.
9. Hadrian Manufacturing Inc.
10. Knickerbocker Partition Corporation.
11. Metpar Corp.
12. Sanymetal; a Crane Plumbing Company

B. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.

1. No-Sightline System: Provide with no-sightline system consisting of a full-height continuous stop on latch side of door and full-height continuous filler strip on hinge side of door.
2. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.
3. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand specified structural performance requirements.
4. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

C. Entrance Screen Construction: Matching panel construction.

D. Urinal-Screen Construction:

1. Wall Hung, Flat-Panel Urinal Screen: Matching panel construction.
2. Wall-Hung, Integral-Flange Urinal Screen: Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.
3. Floor-Anchored Urinal Screen: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Facing Sheets and Closures: Electrolytically coated steel or hot-dip galvanized-steel sheet with nominal base-metal (uncoated) thicknesses as follows:

1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).

2. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.048 inch (1.21 mm).
3. Panels, Doors and Screens: Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).

F. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

G. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

H. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets; chrome-plated zamac or stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

I. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Chrome-plated zamac or stainless steel.

J. Steel Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings.

1. Color: As scheduled or indicated in Design Selections.

2.5 STAINLESS STEEL TOILET COMPARTMENTS

A. Manufacturers:

1. Accurate Partitions Corporation.
2. All American Metal Corp.
3. American Sanitary Partition Corporation.
4. Ampco, Inc.
5. Bradley Corporation; Mills Partitions.
6. Flush Metal Partition Corp.
7. General Partitions Mfg. Corp.
8. Global Steel Products Corp.
9. Hadrian Manufacturing Inc.
10. Knickerbocker Partition Corporation.
11. Metpar Corp.
12. Sanymetal; a Crane Plumbing company

B. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.

1. No-Sightline System: Provide with no-sightline system consisting of a full-height continuous stop on latch side of door and full-height continuous filler strip on hinge side of door.
2. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.
3. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand specified structural performance requirements.

4. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

C. Entrance-Screen Construction: Matching panel construction.

D. Urinal-Screen Construction:

1. Wall Hung, Flat-Panel Urinal Screen: Matching panel construction.
2. Wall Hung, Integral-Flange Urinal Screen: Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.
3. Floor-Anchored Urinal Screen: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Facing Sheets and Closures: Stainless steel sheet of nominal thicknesses as follows:

1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.038 inch (0.95 mm).
2. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.050 inch (1.27 mm).
3. Panels, Doors and Screens: Manufacturer's standard thickness, but not less than 0.038 inch (0.95 mm).

F. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

G. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

H. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets; stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

I. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Chrome-plated zamac or stainless steel.

J. Stainless Steel Finish: Directional Satin Finish: ASTM A480/A480M, No. 4 on exposed faces. Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.

2.6 PLASTIC-LAMINATE-CLAD TOILET COMPARTMENTS

A. Manufacturers:

1. Accurate Partitions Corporation.
2. All American Metal Corp.
3. American Sanitary Partition Corporation.
4. Ampco, Inc.
5. Bobrick Washroom Equipment, Inc.
6. Flush Metal Partition Corp.
7. General Partitions Mfg. Corp.
8. Global Steel Products Corp.
9. Knickerbocker Partition Corporation.
10. Marlite.
11. Metpar Corp.
12. Sanymetal; a Crane Plumbing Company.

B. Door, Panel, and Pilaster Construction: One-piece, plastic-laminate facing sheets pressure laminated to core material without splices or joints in facings or cores; with manufacturer's standard laminate edge trim applied to edges before faces to seal edges and prevent laminate from being pried loose. Seal exposed core material at cutouts to protect core from moisture.

1. No-Sightline System: Provide with no-sightline system consisting of a full-height continuous stop on latch side of door and full-height continuous filler strip on hinge side of door.
2. Core Material:

a. Door and Panel: Particleboard.
b. Pilaster: Particleboard.

3. Thickness:

a. Doors and Panels: Finished to not less than 1 inch (25 mm) thick.
b. Pilasters: Finished to not less than 1-1/4 inches (32 mm) thick; provide internal steel sheet reinforcement where recommended by manufacturer.

C. Entrance-Screen Construction: Matching panel construction.

D. Urinal-Screen Construction:

1. Wall Hung, Flat-Panel Urinal Screen: Matching panel construction.
2. Wall Hung, Integral-Flange, Urinal Screen: Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.
3. Floor-Anchored Urinal Screen: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

F. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

G. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, chrome-plated zamac or stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

H. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Chrome-plated zamac or stainless steel.

I. Plastic-Laminate Finish:

1. Color: As scheduled or indicated in Design Selections.

2.7 PHENOLIC-CORE TOILET COMPARTMENTS

A. Manufacturers:

1. Accurate Partitions Corporation.
2. American Sanitary Partition Corporation.
3. Ampco, Inc.
4. Bobrick Washroom Equipment, Inc.
5. Bradley Corporation; Mills Partitions.
6. Columbia Partitions; a Partition Systems Inc. company
7. Flush Metal Partition Corp.
8. General Partitions Mfg. Corp.

9. Global Steel Products Corp.
10. Knickerbocker Partition Corporation.
11. Metpar Corp.
12. Sanymetal; a Crane Plumbing Company

B. Door, Panel, and Pilaster Construction: Solid phenolic-core material with melamine facing on both sides fused to substrate during manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels.

1. No-Sightline System: Provide with no-sightline system consisting of a full-height continuous stop on latch side of door and full-height continuous filler strip on hinge side of door.

C. Entrance-Screen Construction: Matching panel construction.

D. Urinal-Screen Construction:

1. Wall Hung, Flat-Panel Urinal Screen: Matching panel construction.
2. Floor-Anchored Urinal Screen: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

F. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

G. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design, stainless steel.

H. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Stainless steel.

I. Phenolic Compartment Finish:

1. Color: As scheduled or indicated in Design Selections.

2.8 SOLID-PLASTIC (HDPE) TOILET COMPARTMENTS

A. Manufacturers:

1. Comtec Industries/Capitol Partitions.
2. ASI Global Partitions.
3. Hadrian Manufacturing inc.
4. Santana Products, Inc.
5. Sanymetal; a Crane Plumbing Company.

B. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) material, not less than 1 inch (25 mm) thick, seamless, with eased edges, and with homogenous color throughout thickness of material.

1. No-Sightline System: Provide with no-sightline system consisting of a full-height continuous stop on latch side of door and full-height continuous filler strip on hinge side of door.

2. Heat-Sink Strip: Manufacturer's continuous, extruded-aluminum or stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.

C. Entrance-Screen Construction: Matching panel construction.

D. Urinal-Screen Construction:

1. Wall Hung, Flat-Panel Urinal Screen: Matching panel construction.
2. Floor-Anchored Urinal Screen: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Pilaster Shoes: Manufacturer's standard design; stainless steel.

F. Pilaster Sleeves (Caps): Manufacturer's standard design; stainless steel.

G. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

H. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Stainless steel.

2.9 SIMULATED STONE (SOLID-SURFACING) TOILET COMPARTMENTS

A. Manufacturers:

1. Ampco Product, Inc.
2. Hadrian Manufacturing Inc.
3. Partitions Systems, Inc., Columbia Partitions
4. Watermark Solid Surface, Inc.

B. Door, Panel, and Pilaster Construction: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.material, not less than 3/4 inch (19 mm) thick, seamless, with eased edges, and with homogenous color throughout thickness of material.

1. No-Sightline System: Provide with no-sightline system consisting of a full-height continuous stop on latch side of door and full-height continuous filler strip on hinge side of door.

C. Entrance-Screen Construction: Matching panel construction.

D. Urinal-Screen Construction:

1. Wall Hung, Flat-Panel Urinal Screen: Matching panel construction.
2. Wall Hung, Integral-Flange, Wall-Hung Urinal Screen: Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.
3. Floor-Anchored Urinal Screen: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Pilaster Shoes: Manufacturer's standard design; stainless steel.

F. Pilaster Sleeves (Caps): Manufacturer's standard design; stainless steel.

G. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.
2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

H. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Stainless steel

2.10 COMPARTMENT DOORS

A. Door Hardware and Accessories:

1. Hinges: Manufacturer's standard, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.11 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M).

C. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.

1. Electrolytically Zinc Coated: ASTM A879/A879M, 01Z (03G).
2. Hot-Dip Galvanized: ASTM A653/A653M, either hot-dip galvanized or galvannealed.

D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

E. Stainless Steel Castings: ASTM A743/A743M.

F. Particleboard: ANSI A208.1, Grade M-2.

G. Plastic Laminate: ISO 4586-3, general-purpose HGS grade.

H. Zamac: ASTM B86, commercial zinc-alloy die castings, chrome plated.

2.12 FABRICATION

A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.

B. Overhead-Braced and Floor-Anchored Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Ceiling-Hung Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.

E. Floor-and-Ceiling-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

F. Door Size and Swings: Unless otherwise indicated, provide 28-inch- (700-mm-) wide, in-swinging doors for standard toilet enclosures and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Confirm location and adequacy of blocking and supports required for installation.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels or Screens: 1/2 inch (13 mm).
b. Panels or Screens and Walls: 1 inch (25 mm).

2. Stirrup Brackets: Secure panels or screens to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel.

a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

3. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

C. Overhead-Braced and Floor-Anchored Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

D. Floor-Anchored Units: Set pilasters with anchors penetrating into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

E. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.

F. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.

G. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

3.4 FINISH SCHEDULE

A. Steel Units - Baked Enamel Finish:

1. Color Selection: As selected from manufacturer's standard colors
2. Color Selection: Special Custom Color as selected.
3. Color Selection: Match Architect's sample.
4. Color Selection:

B. Plastic Laminate Finish:

1. Color Selection: As selected from manufacturer's standard colors
2. Color Selection: Match Architect's sample.
3. Color Selection:

C. Phenolic-Core Units:

1. Color Selection: As selected from manufacturer's standard colors
2. Color Selection: Special Custom Color as selected.
3. Color Selection: Match Architect's sample.
4. Color Selection:

D. Solid-Plastic (HDPE) Toilet Compartments:

1. Color Selection: As selected from manufacturer's standard colors
2. Color Selection: Special Custom Color as selected.
3. Color Selection: Match Architect's sample.
4. Color Selection:

E. Simulated Stone (Solid Surfacing) Units:

1. Selection: Match Architect's sample.
2. Selection:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 102613
WALL AND CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Impact-resistant wall protection systems, wall and corner guards, and supplementary items necessary for installation.

B. Related Section:

1. Division 06 Section Plastic (FRP) Panels for non-impact resistant, glass-fiber reinforced (FRP) plastic panels.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, physical characteristics such as durability, resistance to fading, and flame resistance, construction details, installation instructions, and recommendations for maintenance

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification Purposes: For each type of exposed finish on the following products, prepared on Samples of size indicated:

1. Wall Guards: 12 in (300 mm) long samples of each type of component indicated; include examples of joinery, corners, end caps, and field splices.
2. Corner Guards: 12 in (300 mm) long samples of each type of component indicated; include examples of joinery.
3. Wall Protection: 12 in (300 mm) square samples of each wall protection system component required with 6 inch long samples of moldings and trims.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.

2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

a. Store corner-guards, handrails and other protection in a position recommended by manufacturer.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Alpar Architectural Products.
2. American Floor Products Co., Inc.
3. Arden Architectural Specialties, Inc.
4. Construction Specialties, Inc. (C/S Group)
5. IPC Door and Wall Protection Systems; Division of InPro Corporation.
6. Korogard Wall Protection Systems; a division of RJF International Corporation.
7. Pawling Corporation.
8. Tepromark International, Inc.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Accessibility Standards: Comply with applicable provisions in the ADA Standards for Accessible Design, ICC A117.1 Standard for Accessible and Usable Buildings and Facilities, and state and local accessibility code requirements.

2.4 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded and sheet material, thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543 or ASTM D 1308.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.
6. Color and Texture: As scheduled or as indicated in Design Selections.

B. Engineered PETG (Polyethylene Terepthalate Glycol) Material: Textured, chemical- and stain-resistant, high-impact-resistant co-polymer plastic with integral color throughout; PVC-free with no PBTs or BPA, extruded and sheet material, thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543 or ASTM D 1308.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.
6. Color and Texture: As scheduled or as indicated in Design Selections.

C. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.

D. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.

E. Stainless-Steel Sheet: ASTM A 240/A 240M.

F. Brass: ASTM B 249/B 249M for extruded shapes and ASTM B 36/B 36 M for sheet.

G. Solid Wood: Clear hardwood lumber of species indicated, free of appearance defects, and selected for compatible grain and color.

H. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

I. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer.

2.5 PLASTIC / ALUMINUM RETAINER TYPE WALL GUARDS

A. Drawing Designations CR1, CR2, CR3 and CR4 - Surface-Mounted Crash Rail Type Wall Guards:

1. Description:

a. Cover: Snap-on type, extruded plastic; nominal 0.078 in (1.98 mm) thick; continuous in profile indicated.
b. Mounting Retainer: Continuous extruded aluminum retainer; nominal 0.062 in (1.57 mm) thick; with continuous rubber or vinyl bumper material horizontally in retainer.
c. Accessories: Prefabricated, injection-molded matching end caps, inside and outside corners with concealed splices, mounting hardware and other accessories as required.

2. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.:

B. Drawing Designation BG1 - Surface-Mounted Bumper Rail Type Wall Guards:

1. Description:

a. Cover: Snap-on type, extruded plastic; nominal 0.078 in (1.98 mm) thick; continuous in profile indicated.
b. Mounting Retainer: Continuous extruded aluminum retainer; nominal 0.072 in (1.83 mm) thick; with resilient cushion material between retainer and wall.
c. Accessories: Prefabricated, injection-molded matching end caps, inside and outside corners with concealed splices, mounting hardware and other accessories as required.

2. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

C. Drawing Designation HR1 - Surface-Mounted Bumper Rail Type Handrails:

1. Product Quality Standard: ANSI A117.1.
2. Description:

a. Cover: Snap-on type, extruded plastic; nominal 0.078 in (1.98 mm) thick; continuous in profile indicated.
b. Retainer: Continuous extruded aluminum retainer; nominal 0.075 in (1.90 mm) thick; with continuous rubber or vinyl bumper material horizontally in retainer.
c. Mounting Bracket: Extended, prefabricated, injection-molded, plastic mounting brackets.
d. Accessories: Prefabricated, injection-molded matching end caps, inside and outside corners with concealed splices, mounting hardware and other accessories as required.

3. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

D. Drawing Designation BL2 - Surface-Mounted Bed Locators:

1. Description:

a. Cover: Extruded, rigid plastic, nominal 0.078 in (1.98 mm) thick, in dimensions and profiles indicated.
b. Retainer: Continuous extruded aluminum retainer; nominal 0.072 in (1.83 mm) thick; with resilient cushion material between retainer and wall.

c. Accessories: Two matching prefabricated, injection-molded, plastic bed locator end caps and concealed splices, mounting hardware and other accessories as required.

2. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

2.6 PLASTIC / ALUMINUM RETAINER TYPE CORNER GUARDS

A. Drawing Designations CG1, CG2, CG3, and CG4 - Surface-Mounted Corner Guards:

1. Description:

a. Cover: Snap-on type, extruded plastic; nominal 0.078 in (1.98 mm) thick; continuous in profile indicated with 1/4 inch corner radius.
b. Retainer: Continuous extruded aluminum retainer; nominal 0.070 in (1.78 mm) thick.
c. Accessories: Prefabricated, injection-molded matching top cap with concealed splices, mounting hardware and other accessories as required.

2. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

B. Drawing Designation CG5 and CG6 - Flush-Mounted Non-Fire-Rated Corner Guards:

1. Description:

a. Cover: Snap-on type, extruded plastic; nominal 0.078 in (1.98 mm) thick; continuous in profile indicated.
b. Retainer: Continuous extruded aluminum retainer; nominal 0.070 in (1.78 mm) thick.
c. Accessories: Mounting hardware and other accessories as required.

2. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

C. Drawing Designations CG7, CG8, CG9, and CG10 - Flush-Mounted Fire-Rated Corner Guards:

1. Description:

a. Cover: Snap-on type, extruded plastic; nominal 0.078 in (1.98 mm) thick; continuous in profile indicated with 1/4 inch corner radius.
b. Retainer: Continuous extruded aluminum retainer; nominal 0.070 in (1.78 mm) thick.
c. Fire Barrier: Continuous intumescent board or blanket.
d. Accessories: Mounting hardware and other accessories as required.

2. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

D. Drawing Designation CG11, CG12, CG13 and CG14 - Surface-Mounted Non-Fire-Rated Corner Guards:

1. Description: Fabricated from 0.060 in (1.52 mm) thick extruded plastic sheet; wings size as indicated; with formed edges and 90 degree corner.
2. Mounting Method: Adhesive and chrome plated metal screws.
3. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

E. Drawing Designations CG15 - Flush-Mounted Non-Fire-Rated End-of-Wall Corner Guards:

1. Description:

   a. Cover: Snap-on type, extruded plastic; nominal 0.078 in (1.98 mm) thick; continuous in profile indicated with 1/4 inch corner radius.
   b. Retainer: Continuous extruded aluminum retainer; nominal 0.062 in (1.57 mm) thick.
   c. Accessories: Mounting hardware and other accessories as required.

2. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

F. Drawing Designations CG16 - Surface-Mounted Non-Fire Rated End-of-Wall Corner Guards with Wall Protection Inset:

1. Description:

   a. Cover: Snap-on type, extruded plastic; nominal 0.078 in (1.98 mm) thick; continuous in profile indicated with 1/4 inch corner radius.
   b. Retainer: Continuous extruded aluminum retainer; nominal 0.070 in (1.78 mm) thick.
   c. Accessories: Prefabricated, injection-molded matching top cap with concealed splices, mounting hardware and other accessories as required.
   d. Inset: Surface–ÓÓmounted plastic wall protection (WP) as indicated below.

2. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

2.7 STEEL ANGLE TYPE CORNER GUARDS

A. Drawing Designation CG17 - Surface-Mounted Non-Fire Rated Steel Angle Corner Guard:

1. Description: Steel angle 3 in x 3 in x 1/4 in (75 mm x 75 mm x 6mm).
2. Mounting: 1/2 in x 4 in HS embed at 18 in on center.
3. Finish after Fabrication: Hot-Dip Galvanize.

2.8 POLYCARBONATE TYPE CORNER GUARDS

A. Drawing Designation CG18 and CG19 - Surface-Mounted Plastic Corner Guards:

1. Description: Fabricated from 0.085 in (2.2 mm) thick clear polycarbonate plastic sheet; 2 by 2 in (50 by 50 mm) wings; with formed edges and 90 degree corner.
2. Mounting Method: Chrome plated metal screws.
3. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

2.9 STAINLESS STEEL TYPE CORNER GUARDS

A. Drawing Designation CG20, CG21, CG22, CG23 and CG24 - Surface-Mounted Stainless Steel Corner Guards:

1. Description: Fabricated from 16 gage, Type 304 stainless steel; 3-1/2 in x 3-1/2 in (87 by 87 mm) wings; formed edges and corners; No. 4 directional, satin finish, strippable plastic temporary protection.
2. Mounting Method: Structural adhesive.
3. Basis of Design Manufacturers and Products: As scheduled or as indicated in Design Selections.

2.10 SHEET WALL PROTECTION

A. Drawing Designation SWP - Surface-Mounted Sheet Wall Protection:

1. Description: Fabricated from nominal 0.060 in (1.52 mm) thick extruded sheets with matching wainscot and joint moldings and outside and inside corner trims as required.
2. Mounting Method: Structural adhesive with top, edge and seam caps.
3. Basis of Design Manufacturers and Products: C/S Group; Acrovyn; as scheduled or as indicated in Design Selections.

2.11 STAINLESS STEEL WALL PROTECTION

A. Drawing Designation SSWP - Surface-Mounted Stainless Steel Sheet Wall Protection:

1. Description: Fabricated from 16 gauge (1.59 mm), Type 304 stainless steel sheets; matching wainscot and joint moldings and outside and inside corner trims as required; No. 4, satin finish, strippable plastic temporary protection.

a. Texture: Smooth or diamond plate as scheduled.

2. Mounting Method: Structural adhesive with top, edge and seam caps.

2.12 FABRICATION

A. General Requirements: Fabricate wall protection system components to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.13 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Examine walls to which protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

a. For protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Complete finishing operations, including painting, before installing protection.

C. Before installation, clean substrate to remove dust, debris, and loose particles.

3.4 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 ft (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 in (300 mm).
3. Adjust end and top caps as required to ensure tight seams.

D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.5 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

3.6 FINISH SCHEDULE

A. Color and Texture: As selected by Architect from full range of industry colors.

B. Color and Texture:

1. Manufacturer: <INSERT>
2. Selection:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 102813
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Toilet accessories and supplementary items necessary for installation.

1. Refer to Drawings and Schedules for Public Area and Guestroom accessories.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, dimensions, and profiles of individual components.
2. Include details for cutouts required in other Work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

B. Accessory Schedule: Organized by rooms, indicating types, quantities, sizes, and installation locations of each accessory, using drawing designations and room names and numbers as indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For inclusion in operation and maintenance manual as required by Division 01 Section "Operation and Maintenance Data". Include manufacturer's instructions for maintenance of installed Work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Mock-Ups: Prior to beginning Work of this Section, install mock-ups of toilet accessories, incorporating backup wall construction, to demonstrate surface preparation. Build mock-up using materials indicated for the completed Work.

1. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.
2. Accepted mock-ups may become part of completed Work if undisturbed at time of Substantial Completion.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 COORDINATION

A. Coordinate installation of products with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

A. Mirror Manufacturer's Warranty: Furnish warranty for a period of 15 years from date of Substantial Completion agreeing to replace mirrors that develop visible silver spoilage defects, signed by an authorized representative using manufacturer's standard form.

B. Hand Dryer Manufacturer's Warranty: Furnish warranty for a period of 10 years from date of Substantial Completion agreeing to repair or replace defective or faulty dryers, signed by an authorized representative using manufacturer's standard form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into Work include but are not limited to those listed.

C. Manufacturers and Products:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corp.
5. Brey Krause Manufacturing.
6. GAMCO, a Division of Bobrick.

D. Shower Curtain Products:

1. Barjan Manufacturing Ltd.
2. Brite Inc.
3. Gary Manufacturing.

E. Child and Adult Care Products:

1. Brocar Products, Inc. (Foundations Quality Children's Products)
2. Koala Kare Products.

F. Hand Dryer Products:

1. American Dryer, Inc.
2. Excel Dryer Inc.
3. Saniflow Corporation, div of Mediclinics.
4. World Dryer Corp.

G. Basis of Design: Contract Documents are based on products specified to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and do not change intended aesthetic, functional and performance requirements as judged by Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. General Requirements:

1. Unless otherwise indicated, fabricate units of all-welded construction, with corners and returns as indicated, tight seams and joints, and exposed edges rolled.
2. Fabricate frames drawn and leveled, one-piece seamless construction.
3. Hang doors and access panels with full-length, stainless-steel hinges.
4. Equip units for concealed anchorage and with corrosion-resistant backing plates.

C. Manufacturer Names or Labels: Not permitted on exposed faces of accessories. Provide printed label or stamped metal nameplate indicating manufacturer's name and product model number on an easily noticeable interior surface or on back surface of each accessory.

D. Keys: Provide minimum of 6 universal keys for internal access to accessories for servicing and resupplying.

E. Accessibility Requirements: Products and installation shall comply with Americans with Disabilities Act (ADA), ANSI A 117.1, and state and local accessibility standards.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2.3 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 satin finish; minimum 0.0312 in (0.8 mm) (22 gage) nominal thickness unless otherwise indicated.

B. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 1/4 in (6 mm) thick, with silvering, electroplated copper coating, and protective organic coating.

C. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

D. ABS Plastic: Moldable acrylonitrile-butadiene-styrene resin formulation.

E. HDPE Plastic: Moldable high-density polyethylene resin formulation.

F. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of non-corrosive metal when concealed.

H. Sealant: Silicone mildew resistant sealant specified in Division 07 Section "Joint Sealants".

2.4 PAPER TOWEL DISPENSERS

A. Drawing Designation A1 - Surface-Mounted Paper Towel Dispenser:

1. Description: Fabricated of stainless steel; with hinged front equipped with full length stainless steel piano hinge and tumbler lock; pierced slots at sides as refill indicators; and sized to dispense not less than 400 C-fold or 525 multi-fold paper towels without special adapters.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-262.

B. Drawing Designation A2 - Recessed-Mounted Paper Towel Dispenser:

1. Description: Fabricated of stainless steel; with seamless exposed flange and hinged front equipped with full length stainless steel piano hinge, door-swing cable limiter, and tumbler lock; sized to dispense not less than 350 C-fold or 475 multi-fold paper towels without use of special adapters; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-359.

C. Drawing Designation A3 - Concealed Paper Towel Dispenser:

1. Description: Fabricated of stainless steel; equipped with two self-closing piano hinged panels; designed for recess mounting behind continuous mirror; sized to dispense minimum 600 C-fold or 800 multi-fold paper towels without special adapters.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-318.

D. Drawing Designation A4 - Surface Mounted Automatic Paper Towel (Roll) Dispenser:

1. Description: Surface mounted, automatic motion sensing mechanism with user-adjustable delay and paper towel length; battery powered. Sized to dispense 8 in (203 mm) wide, 800 ft (244 m) long roll. Lockset: Tumbler type.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-72974

E. Drawing Designation A5 - Owner Furnished Paper Towel Dispenser: Refer to Division 01 Sections "Summary" and "Execution" for general requirements.

2.5 TOILET TISSUE DISPENSERS

A. Drawing Designation B1 - Surface-Mounted Double-Roll Toilet Tissue Dispenser:

1. Description: Fabricated of heavy duty cast aluminum; sized to accommodate two separate 5 in (125 mm) diameter core type tissue rolls; molded ABS spindle, theft-resistant, with retractable pin and concealed locking mechanism.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-2740.

B. Drawing Designation B2 - Surface-Mounted Single-Roll Toilet Tissue Dispenser:

1. Description: Fabricated of heavy duty cast aluminum; sized to accommodate 5 in (125 mm) diameter core type tissue roll; molded ABS spindle, theft-resistant, with retractable pin and concealed locking mechanism.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-2730.

C. Drawing Designation B3 - Surface-Mounted Multi Roll Toilet Tissue Dispenser:

1. Description: Fabricated of stainless steel; with hinged front equipped with pivot hinge and tumbler lock; sized to store and dispense two 5 in (125 mm) diameter core type tissue rolls with reserve roll placed in service automatically when bottom roll is depleted; molded ABS spindle, theft-resistant, and held in dispenser when door is locked.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-2888.

D. Drawing Designation B4 - Recessed-Mounted Multi Roll Toilet Tissue Dispenser:

1. Description: Fabricated of stainless steel; with seamless exposed flange and hinged front equipped with pivot hinge and tumbler lock; sized to store and dispense two 5 in (125 mm) diameter core type tissue rolls with reserve roll placed in service automatically when bottom roll is depleted; molded ABS spindle, theft-resistant and held in dispenser when door is locked; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-3888.

E. Drawing Designation B5 - Partition-Mounted Multi-Roll Toilet Tissue Dispenser:

1. Description: Fabricated of stainless steel; with seamless exposed flange and hinged front equipped with pivot hinge and tumbler lock; sized to store and dispense two 5 in (125 mm) diameter core type tissue rolls with reserve roll placed in service automatically when bottom roll is depleted; molded ABS spindle, theft-resistant and held in dispenser when door is locked; for partition mounting serving two toilet compartments.
2. Basis of Design: American Specialties, Inc. Model 0032.

F. Drawing Designation B6 - Owner Furnished Toilet Tissue Dispenser: Refer to Division 01 Sections "Summary" and "Execution" for general requirements.

G. Drawing Designation B7 - Recessed-Mounted Toilet Paper Holder (Psychiatric Use):

1. Description: Fabricated of stainless steel with seamless exposed flange; concealed mounting clamp studs for stud walls with spanner head exposed fasteners; chrome plated spindle with internal spring.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-6677.

H. Drawing Designation B8 - Recessed-Mounted Toilet Paper Holder (Detention / Psychiatric Use):

1. Description: Fabricated of stainless steel, minimum 0.0625 in (1.6 mm) (16 gage) thick; with threaded studs welded to back for anchoring to wall with anchor plate; sized to store one 5 in (125 mm) diameter core type tissue roll.
2. Basis of Design: Bradley Corporation Model SA11.

I. Drawing Designation B9 - Surface-Mounted Twin Jumbo Roll Toilet Tissue Dispenser:

1. Description: Fabricated of stainless steel, cabinet of 0.040 in (1.0 mm) (20 gage) thick, door of 0.050 in (1.25 mm) (18 gage) thick; door with viewing slot, continuous piano hinge and tumbler lock; sized to store two 10 in (250 mm) diameter, 3 in (75 mm) diameter core type, tissue roll; spindles convertible to standard size toilet tissue rolls.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-2892.

J. Drawing Designation B10 - Recessed-Mounted Facial Tissue Dispenser:

1. Description: Fabricated of stainless steel, beveled edges on snap-on cover, corrosion-resistant steel mounting cabinet; sized to dispense not less than 300 two-ply tissues; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: GAMCO Commercial Restroom Accessories Model B-355.

2.6 WASTE RECEPTACLES

A. Drawing Designation C1 - Surface-Mounted Waste Receptacle:

1. Description: Fabricated of stainless steel; with seamless exposed walls and continuously welded bottom pan; with removable 20 gal (75.7 L) capacity heavy-gauge vinyl liner secured to receptacle with interior stainless steel hooks.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-275.

B. Drawing Designation C2 - Recessed-Mounted Waste Receptacle:

1. Description: Fabricated of stainless steel; with seamless door with returned edges, equipped with full length stainless steel piano hinge, and tumbler locks; with removable 12 gal (44 L) capacity molded plastic liner; for nominal 8 in (200 mm) wall depth.
2. Basis of Design: Bradley Corporation Model B-35643.

C. Drawing Designation C3 - Semi-Recessed-Mounted Waste Receptacle:

1. Description: Fabricated of stainless steel; with seamless exposed flange; removable stainless steel receptacle with seamless exposed walls, hemmed edges, secured by tumbler lock; with removable 12 gal (45.5 L) capacity heavy-gauge vinyl liner secured to receptacle with interior stainless steel hooks; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-3644.

D. Drawing Designation C4 - Owner Furnished Waste Receptacle: Refer to Division 01 Sections "Summary" and "Execution" for general requirements.

2.7 COMBINATION TOWEL DISPENSER / WASTE RECEPTACLES

A. Drawing Designation D1 - Semi-Recessed-Mounted Combination Towel Dispenser / Projecting Waste Receptacle:

1. Description: Fabricated of stainless steel; with seamless exposed flange; towel dispenser in upper portion of unit with hinged front, equipped with full length stainless steel piano hinge, designed to dispense not less than 600 C-fold or 800 multi-fold paper towels; projecting waste receptacle in lower portion of unit secured in place by tumbler lock, provided with removable 12 gal (45.5 L) capacity heavy-gauge vinyl liner secured to receptacle with interior stainless steel hooks; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-3944.

B. Drawing Designation D2 - Recessed-Mounted Combination Towel Dispenser / Waste Receptacle:

1. Description: Fabricated of stainless steel; with seamless exposed flange; towel dispenser in upper portion of unit with hinged front, equipped with full length stainless steel piano hinge, designed to dispense not less than 600 C-fold or 800 multi-fold paper towels; recessed waste receptacle in lower portion of unit secured in place by tumbler lock, provided with removable 12 gal (45.5 L) capacity, heavy-gauge vinyl liner secured to receptacle with interior stainless steel hooks; for nominal 8 in (200 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-39003.

C. Drawing Designation D3 - Semi-Recessed-Mounted Combination Towel Dispenser / Projecting Waste Receptacle:

1. Description: Fabricated of stainless steel; with seamless exposed flange; towel dispenser in upper portion of unit with hinged front, equipped with full length stainless steel piano hinge, designed to dispense not less than 600 C-fold or 800 multi-fold paper towels; projecting waste receptacle in lower portion of unit secured in place by tumbler lock, provided with removable 18 gal (68 L) capacity heavy-gauge vinyl liner secured to receptacle with interior stainless steel hooks; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-3947.

2.8 GRAB BARS

A. Drawing Designation E1, E2, E3, E4, E5, E6, - Straight Surface-Mounted Satin Finish Grab Bar with Slip-Resistant Gripping Surface:

1. Description: Fabricated of stainless steel tube; with minimum 0.050 in (1.25 mm) (18 gage) wall thickness and 1-1/2 in (38 mm) outside diameter, with 1-1/2 in (38 mm) clearance between wall surface and inside face of bar.

   a. Gripping Surfaces: Satin texture with peened gripping surfaces.
   b. Shapes: Either as indicated, or as required by condition requiring grab bar.
   c. Mounting: Concealed flanged steel plate welded to end of bar, as required by mounting condition, with snap-on cover; engineered to support minimum 300 lbs (136 kg).

2. Basis of Design:

   a. E1: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 12; 12 in (300 mm).
   b. E2: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 18; 18 in (450 mm).
   c. E3: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 24; 24 in (600 mm).
   d. E4: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 36 36 in (900 mm).
   e. E5: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 42; 42 in (1050 mm).
   f. E6: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 48; 48 in (1220 mm).
   g. E15: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 18; 18 in (450 mm).

B. Drawing Designation E7, E8, E14, E16 - Configured Surface-Mounted Satin Finish Grab Bar with Slip-Resistant Gripping Surface:

1. Description: Fabricated of stainless steel tube; with minimum 0.050 in (1.25 mm) (18 gage) wall thickness and 1-1/2 in (38 mm) outside diameter, with 1-1/2 in (38 mm) clearance between wall surface and inside face of bar.

   a. Gripping Surfaces: Satin texture with peened gripping surfaces.
   b. Shapes: Either as indicated, or as required by condition requiring the grab bar.
   c. Mounting: Concealed flanged steel plate welded to end of bar, as required by mounting condition, with snap-on cover; engineered to support minimum 300 lbs (136 kg).

2. Basis of Design:

   a. E7: Bobrick Washroom Equipment, Inc. Model B-6861.99 16 in x 31 in (400 mm x 775 mm) unit.
   b. E8: A & J Washroom Accessories, Inc. Model UG30X-Type V; at dimensions shown. 24 in x 60 in x 24 in (600 mm x 1500 mm x 600 mm) nominal size.
   c. E14: Bobrick Washroom Equipment, Inc. Model B-68616.99, modified for 24 in x 42 in (600 mm x 1050 mm) unit.
   d. E16: Bobrick Washroom Equipment, Inc. Model B-68616.99, modified for 42 in x 54 in (1050 mm x 1350 mm) unit.

C. Drawing Designation E9, E10, E11, E12, E13 - Surface-Mounted Satin Finish Security Grab Bars with Non-Slip Gripping Surface (Psychiatric Use):

1. Description: Fabricated of stainless steel tube; with minimum 0.050 in (1.25 mm) (18 gage) wall thickness and 1-1/2 in (38 mm) outside diameter, with 1-1/2 in (38 mm) clearance between wall surface and inside face of bar; with 0.125 in (3 mm) (11 gage) stainless steel closure plate TIG welded to underside of bar and extending to wall.

   a. Gripping Surfaces: Satin texture with non-slip gripping surfaces.
   b. Shapes: Either as indicated, or as required by condition requiring the grab bar.

c. Mounting: Exposed flanged steel plate welded to end of bar; with three 1/4 in (6 mm) diameter threaded rods welded to each flange for rear mounting through wall (coordinate wall thickness); with nuts and washers; engineered to support minimum 300 lbs (136 kg).

2. Basis of Design:

a. E9: American Specialties, Inc. Model 160; 24 in (600 mm).
b. E10: American Specialties, Inc. Model 161; 30 in (750 mm).
c. E11: American Specialties, Inc. Model 163; 36 in (900 mm).
d. E12: American Specialties, Inc. Model 166; 42 in (1050 mm).
e. E13: American Specialties, Inc. Model 168; 48 in (1200 mm).

2.9 SANITARY NAPKIN VENDORS

A. Drawing Designation F1 - Surface-Mounted Sanitary Napkin Vendor:

1. Description: Fabricated of stainless steel; with seamless door with returned edges, minimum 0.050 in (1.25 mm) (18 gage) thick, equipped with full length stainless steel piano hinge, door-swing cable limiter, and two tumbler locks; identification reading "Napkins" and "Tampons" at coin slots; brand name advertising not allowed.

a. Capacity: Not less than 20 napkins and 30 tampons.
b. Coin Mechanism: Field convertible, impact-resistant mechanism with pull-knob, with locked coin box keyed separately from door and other toilet accessory units; factory set at fifty cent coin operation.

2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-2706 50.

B. Drawing Designation F2 - Recessed-Mounted Sanitary Napkin Vendor:

1. Description: Fabricated of stainless steel; with seamless door with returned edges, minimum 0.050 in (1.25 mm) (18 gage) thick, equipped with full length stainless steel piano hinge, door-swing cable limiter, and two tumbler locks; identification reading "Napkins" and "Tampons" at coin slots; brand name advertising not allowed; for nominal 4 in (100 mm) wall depth.

a. Capacity: Not less than 20 napkins and 30 tampons.
b. Coin Mechanism: Field convertible, impact-resistant mechanism with pull-knob, with locked coin box keyed separately from door and other toilet accessory units; factory set at fifty cent coin operation.

2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-3706 50.

2.10 SANITARY NAPKIN DISPOSAL UNITS

A. Drawing Designation G1 - Surface-Mounted Sanitary Napkin Disposal Unit:

1. Description: Fabricated of stainless steel; with flush door equipped with continuous piano hinge and tumbler lock; self-closing disposal panel with spring-loaded full length stainless steel piano hinge and international symbol for sanitary napkin disposal; with removable 1.2 gal (4.6 L) capacity molded polyethylene receptacle.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-254.

B. Drawing Designation G2 - Recessed-Mounted Sanitary Napkin Disposal Unit:

1. Description: Fabricated of stainless steel; with seamless exposed flange; with flush door equipped with continuous piano hinge and tumbler lock; self-closing disposal panel with spring-loaded full length stainless steel piano hinge and international symbol for sanitary

napkin disposal; with removable 1.2 gal (4.6 L) capacity molded polyethylene receptacle; for nominal 4 in (100 mm) wall depth.

2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-353.

C. Drawing Designation G3 - Partition-Mounted Dual-Access Sanitary Napkin Disposal Unit:

1. Description: Fabricated of stainless steel; with seamless adjustable exposed flange at both partition faces; self-closing disposal panel at both partition faces with spring-loaded full length stainless steel piano hinge and international symbol for sanitary napkin disposal; with removable 1.2 gal (4.6 L) capacity molded polyethylene receptacle.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-354.

2.11 MULTIPURPOSE UNITS

A. Drawing Designation H1 - Recessed-Mounted Multipurpose Unit (Soap and Towel Dispensers):

1. Description: Fabricated of stainless steel; with seamless exposed flange; with hinged door equipped with full length stainless steel piano hinge and tumbler lock; paper towel dispenser designed to dispense minimum of 150 C-fold or 250 multi-fold paper towels without special adapters; minimum 40 fl oz (1.2 L) capacity liquid soap dispenser, with sight gage and tumbler lock for servicing; shelf below towel dispenser; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bradley Corporation Model 1471.

B. Drawing Designation H2 - Recessed-Mounted Multipurpose Unit (Toilet Tissue and Toilet Seat Cover Dispensers and Sanitary Napkin Disposal):

1. Description: Fabricated of stainless steel; with seamless exposed flange; with hinged door equipped with full length stainless steel piano hinge and tumbler lock; sized to accommodate two separate 5-1/4 in (131 mm) diameter core type tissue rolls with theft-resistant molded ABS spindle; self-closing sanitary napkin disposal panel with spring-loaded full length stainless steel piano hinge and international symbol for sanitary napkin disposal with removable 0.8 gal (3.0 L) capacity molded polyethylene receptacle; with opening in face for dispensing toilet seat covers - minimum 500 seat cover capacity; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-3574.

C. Drawing Designation H3 - Partition-Mounted Multipurpose Unit (Toilet Tissue and Toilet Seat Cover Dispensers and Sanitary Napkin Disposal):

1. Description: Fabricated of stainless steel; with seamless exposed flange; with hinged door equipped with full length stainless steel piano hinge and tumbler lock; sized to accommodate four separate 5-1/4 in (131 mm) diameter core type tissue rolls with theft-resistant molded ABS spindle; self-closing sanitary napkin disposal panel with spring-loaded full length stainless steel piano hinge and international symbol for sanitary napkin disposal with removable 0.8 gal (3.0 L) capacity molded polyethylene receptacle; with opening in face for dispensing toilet seat covers - minimum 1000 seat cover capacity; for partition mounting serving two toilet compartments.
2. Basis of Design:
   a. Partition-mounted with one side of partition having grab bars: Bobrick Washroom Equipment, Inc. Model B-3571.
   b. Partition-mounted with neither side of partition having grab bars: Bobrick Washroom Equipment, Inc. Model B-357.

2.12 SOAP DISPENSERS

A. Drawing Designation J1 - Surface-Mounted Soap Dispenser:

1. Description: Fabricated of stainless steel; with stainless steel cover with unbreakable clear acrylic refill indicator window; minimum 40 fl oz (1.2 L) capacity liquid soap dispenser, with stainless steel piston, springs, and internal parts designed to dispense in measured quantity by pump action.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-2112.

B. Drawing Designation J2 - Recessed-Mounted Soap Dispenser:

1. Description: Fabricated of stainless steel; with seamless door with returned edges, equipped with full length stainless steel piano hinge, tumbler lock, and polycarbonate refill indicator window; minimum 45 fl oz (1.3 L) capacity molded plastic liquid soap dispenser, with stainless steel piston, springs, and internal parts designed to dispense in measured quantity by pump action; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-306.

C. Drawing Designation J3 - Counter-Mounted Soap Dispenser:

1. Description: Designed for mounting through lavatory counter; polished stainless steel piston and spout-type unit with 6 in (150 mm) long duckbill-style spout, chrome-plated high-impact resistant ABS deck escutcheon, and polyethylene reservoir concealed below deck; minimum 34 fl oz (1.0 L) capacity liquid soap dispenser.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-8226.

D. Drawing Designation J4 - Owner Furnished Soap Dispenser: Refer to Division 01 Sections "Summary" and "Execution" for general requirements.

2.13 TOILET SEAT COVER DISPENSERS

A. Drawing Designation K1 - Surface-Mounted Toilet Seat Cover Dispenser:

1. Description: Fabricated of stainless steel; with opening in face for dispensing covers and concealed opening at bottom for filling; minimum 250 seat cover capacity.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-221.

B. Drawing Designation K2 - Recessed-Mounted Toilet Seat Cover Dispenser:

1. Description: Fabricated of stainless steel; with seamless exposed flange; hinged front with full length stainless steel piano hinge and tumbler lock; minimum 500 seat cover capacity; for nominal 4 in (100 mm) wall depth.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-301.

2.14 SHOWER CURTAIN ROD, HOOKS, AND CURTAIN

A. Drawing Designation L1 - Extra-Heavy-Duty Shower Curtain Rod, Hooks, and Curtain:

1. Rod: As specified below:

a. Description: Fabricated of stainless steel tube; 1-1/4 in (30 mm) outside diameter, 0.050 in (1.2 mm) (18 gage), satin finish; with die-formed nominal 2-1/2 in (62 mm) square minimum 0.0375 in (0.9 mm) (20 gage) stainless steel flanges with satin finish, and designed for exposed fasteners; length to accommodate opening width.
b. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-6047.

2. Hooks: As specified below:

a. Description: Fabricated of stainless steel; 0.09 in (2 mm) diameter spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod size; one hook per curtain grommet.
b. Basis of Design: Bobrick Washroom Equipment, Inc. Part 204-1.

3. Curtain: As specified in Division 01 Section "Interior Design Selections".
4. Curtain: As specified below:

   a. Description: Custom fabricated of white nylon with sides and bottom hemmed, with hemmed reinforced top header containing corrosion-resistant grommets; containing anti-static, anti-bacterial and flame-retardant agents, minimum 10 mils (0.25 mm) thick.
   b. Manufacturers:

      1) Barjan Manufacturing Ltd.
      2) Brite Inc.
      3) Gary Manufacturing.

B. Drawing Designation L2 - Ceiling-Mounted Breakaway Shower Carriers: Refer to Division 10 Section "Cubicles" for ceiling-mounted shower curtain tracks for detention or psychiatric use.

1. Curtain: As specified with Designation L1 above.
2. Curtain: As specified in Division 01 Section "Interior Design Selections".
3. Curtain: As specified below:

   a. Description: Custom fabricated of white nylon with sides and bottom hemmed, with hemmed reinforced top header containing corrosion-resistant grommets; containing anti-static, anti-bacterial and flame-retardant agents, minimum 10 mils (0.25 mm) thick.
   b. Manufacturers:

      1) Barjan Manufacturing Ltd.
      2) Brite Inc.
      3) Gary Manufacturing.

2.15 SOAP DISHES

A. Drawing Designation M1 - Surface-Mounted Soap Dish:

1. Description: Fabricated of stainless steel; one-piece with drain holes; welded to support arm anchored to wall with 0.050 in (1.25 mm) (18 gage) concealed mounting bracket.
2. Basis of Design: Gamco, Model 76807.

B. Drawing Designation M2 - Recessed-Mounted Heavy-Duty Soap Dish:

1. Description: Fabricated of stainless steel; one-piece seamless shell and flange, 19 gage (1.0 mm), matte polished finish, for recess mounting in wall; furnish with 0.0375 in (0.8 mm) (20 gage) mounting clamp.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-4380.

C. Drawing Designation M3 - Recessed-Mounted Ceramic Soap Dish: Refer to Division 09 Section "Tiling".

2.16 FOLDING SHOWER SEATS

A. Drawing Designation N1 - Surface-Mounted Folding Shower Seat:

1. Description: Fabricated of stainless steel minimum 0.0625 in (1.6 mm) (16 gage) square tubing and with 0.050 in (1.25 mm) (18 gage) round tubing; reversible L-shaped hinged seat made of phenolic or polymeric composite of either slat type or one-piece construction, with support braces, hinges, and frame designed to fold up against wall when not in use; color as selected by Architect from selections available. Shower seat shall comply with barrier-free accessibility guidelines.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-5181.

B. Drawing Designation N2 - Surface-Mounted Folding Shower Seat:

1. Description: Fabricated of stainless steel minimum 0.0625 in (1.6 mm) (16 gage) square tubing and with 0.050 in (1.25 mm) (18 gage) round tubing; one piece, rectangular-shaped hinged seat made of phenolic or polymeric composite of either slat type or one-piece construction, with support braces, hinges, and frame designed to fold up against wall when not in use; color as selected by Architect from selections available. Shower seat shall comply with barrier-free accessibility guidelines.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-5193.

2.17 MOP AND BROOM HOLDERS

A. Drawing Designation P1 - Surface-Mounted Mop and Broom Holder with Utility Shelf:

1. Description: Fabricated of stainless steel, minimum 0.050 in (1.25 mm) (18 gage) thick shelf with returned edges, and support brackets for wall mounting; with three 0.0625 in (1.6 mm) (16 gage) stainless steel rag hooks on front of shelf, together with four spring-loaded, rubber hat, cam-type mop/broom holders; 1/4 in (6 mm) diameter stainless steel drying rod suspended beneath shelf; 36 in (900 mm) long.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-224 X 36.

B. Drawing Designation P2 - Surface-Mounted Mop and Broom Holder without Utility Shelf:

1. Description: Fabricated of stainless steel, minimum 0.050 in (1.25 mm) (18 gage) thick hat channel with 3 spring-loaded, rubber hat, cam-type mop/broom holders; 36 in (900 mm) long.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-223 X 36.

2.18 CHILD CARE PRODUCTS

A. Drawing Designation Q1 - Surface-Mounted Diaper Changing Station:

1. Product Quality Standard: ASTM F 2285.
2. Description: Fabricated of molded HDPE body with bed folding from vertical stored position to horizontal use position; with steel mounting plates; with concealed dampened pneumatic cylinder for controlled, slow opening and closing speed, and steel hinge mechanism fully concealed to eliminate potential for pining; project not more than 4 in (100 mm) from wall when closed; engineered to support minimum 250 lbs (113 kg) when opened; with nylon or vinyl safety strap, hooks for hanging purse and bags, self-latching lock requiring no keys, built-in sanitary liner dispenser, and universal instruction graphics and safety messages.
3. Manufacturers and Products:

   a. American Specialties, Inc. Model 9012.
   b. Bradley Corporation Model 9612.
   c. Brocar Products, Inc. Model 100-EH.
   d. Koala Kare Products Model KB-200-00.

B. Drawing Designation Q2 - Surface-Mounted Folding Child Seat:

1. Description: Fabricated of molded HDPE body with seat folding from vertical stored position to horizontal use position; with steel mounting plates; with concealed dampened pneumatic cylinder for controlled, slow opening and closing speed, and steel hinge mechanism fully concealed to eliminate potential for pining; project not more than 6 in (150 mm) from wall when closed; engineered to support minimum 50 lbs (22 kg) when opened; with nylon or vinyl safety strap that extend over child's shoulders and between legs, hooks for hanging purse and bags, self-latching lock requiring no keys, and universal instruction graphics and safety messages.

2. Manufacturers and Products:

   a. Brocar Products, Inc. Model 103-BQS.
   b. Koala Kare Products Model KB102-00.

C. Drawing Designation Q5 - Recessed-Mounted Stainless Steel Diaper Changing Station:

1. Product Quality Standard: ASTM F 2285.
2. Description: Exterior case fabricated of stainless steel with molded HDPE interior body with bed folding from vertical stored position to horizontal use position; with steel mounting plates; with concealed dampened pneumatic cylinder for controlled, slow opening and closing speed, and steel hinge mechanism fully concealed to eliminate potential for pining; engineered to support minimum 250 lbs (113 kg) when opened; with nylon or vinyl safety strap, hooks for hanging purse and bags, self-latching lock requiring no keys, built-in sanitary liner dispenser, and universal instruction graphics and safety messages; for nominal 4 in (100 mm) wall depth.
3. Manufacturers and Products:

   a. American Specialties, Inc. Model 9013.
   b. Bradley Corporation Model 962.
   c. Brocar Products, Inc. Model 100SS-R.
   d. Koala Kare Products Model KB110-SSRE.

2.19 ADULT CARE PRODUCTS

A. Drawing Designation Q6 - Recessed-Mounted Stainless Steel Adult Special Needs Changing Station for physically challenged persons:

1. Product Quality Standard: ASTM F 2285.
2. Description: Exterior case fabricated of 16-gage stainless steel with softened edges and rounded plastic corners; concave molded insulated polystyrene replaceable tray liner; folding from vertical stored position to horizontal use position; with steel mounting plates; with concealed dampened pneumatic cylinder for controlled, slow opening and closing speed, and steel hinge mechanism fully concealed to eliminate potential for pining; engineered to support minimum 400 lbs (182 kg) when opened; with nylon safety strap with cam buckle adjustable with one hand; self-latching lock requiring no keys; and universal instruction graphics and safety messages; for nominal 4 in (100 mm) wall depth.
3. Unit Overall Size: 64-13/16 in (1620 mm) wide by 23-1/2 in (587 mm). When open, bed projects 17-1/2 in (437 mm) from face of wall.
4. Basis of Design: Brocar Products, Inc. Model 100SSE-R.

B. Drawing Designation Q7 - Surface-Mounted Stainless Steel Adult Special Needs Changing Station for physically challenged persons:

1. Product Quality Standard: ASTM F 2285.
2. Description: Exterior case fabricated of 16-gage stainless steel with softened edges and rounded plastic corners; concave molded insulated polystyrene replaceable tray liner; folding from vertical stored position to horizontal use position; with steel mounting plates; with concealed dampened pneumatic cylinder for controlled, slow opening and closing speed, and steel hinge mechanism fully concealed to eliminate potential for pining; engineered to support minimum 400 lbs (182 kg) when opened; with nylon safety strap with cam buckle adjustable with one hand; self-latching lock requiring no keys; and universal instruction graphics and safety messages.
3. Unit Overall Size: 64-13/16 in (1620 mm) wide by 23-1/2 in (587 mm) high and projecting maximum of 4 in (100 mm) from wall when closed. When open, bed projects 21 in (525 mm) from face of wall.

4. Basis of Design: Brocar Products, Inc. Model 100SSE-SM.

2.20 SHELVING UNITS

A. Drawing Designation Q3 - Surface-Mounted Fold-Down Utility Shelf:

1. Description: Fabricated of stainless steel, minimum 0.050 in (1.25 mm) (18 gage) thick; fold-down, 15 in (375 mm) long by 5-1/2 in (137 mm) wide, hinged shelf; spring-loaded to provide automatic return to vertical position.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-287.

B. Drawing Designation Q4 - Surface-Mounted Shelf and Hook Strip:

1. Descriptions: Fabricated of stainless steel.

a. Shelf Unit: Minimum 0.050 in (1.25 mm) (18 gage) thick shelf with 0.0625 in (1.6 mm) (16 gage) thick brackets; minimum 18 in (455 mm) wide by 8 in (200 mm) deep.
b. Hook Strip: Minimum 0.078 in (1.9 mm) (14 gage) thick faceplate, minimum 18 in (455 mm) wide by 5-1/2 in (140 mm) high; with four stainless steel hooks that snap down when heavily loaded.

2. Basis of Design:

a. Shelf: Bobrick Washroom Equipment, Inc. Model B-298 X 18.
b. Hook Strip: Bobrick Washroom Equipment, Inc. Model B-985.

C. Drawing Designation Q8 - Surface-Mounted Shelf:

1. Description: Fabricated of stainless steel with satin finish, minimum 0.050 in (1.25 mm) (18 gage) thick shelf with 0.0625 in (1.6 mm) (16 gage) thick brackets; minimum 18 in (450 mm) wide by 8 in (200 mm) deep.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-298 X 18.

D. Drawing Designation Q9 - Surface-Mounted Towel Shelf:

1. Description: Fabricated of stainless steel with satin finish, minimum 0.375 in (9.5 mm) diameter tubing for shelf, 0.034 in (0.8 mm) (22 gage) thick flanges and support arms, and 0.050 in (1.25 mm) (18 gage) mounting brackets; 24 in (600 mm) wide by 8 in (200 mm) deep.
2. Basis of Design: Bradley Corp. Model 9104.

2.21 MIRRORS

A. Drawing Designation R1 - Surface-Mounted Stainless Steel Framed Mirror (without Shelf):

1. Description: Fabricated of stainless steel; exposed frame with angle shapes not less than 0.050 in (1.25 mm) (18 gage) thick, with square corners mitered, welded, and ground smooth, and to accommodate glass edge protection material; with galvanized steel backing sheet, minimum 0.034 in (0.8 mm) (22 gage) in thick and full mirror size, with non-absorptive filler material (corrugated cardboard not acceptable), and with hanging brackets; glass mirror.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-290 2436.

B. Drawing Designation R2 - Surface-Mounted Stainless Steel Framed Mirror with Shelf:

1. Description: Fabricated of stainless steel; exposed frame with angle shapes not less than 0.050 in (1.25 mm) (18 gage) thick, with square corners mitered, welded, and ground smooth, and to accommodate glass edge protection material; shelf fabricated of stainless steel, minimum 0.050 in (1.25 mm) (18 gage) thick with returned edges, and

welded to bottom of frame, approximately 5 in (125 mm) deep by width of mirror; with galvanized steel backing sheet, minimum 0.034 in (0.8 mm) (22 gage) in thick and full mirror size, with non-absorptive filler material (corrugated cardboard not acceptable), and with hanging brackets; glass mirror.

2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-292 2436.

C. Drawing Designation R3 - Surface-Mounted Stainless Steel Framed Mirror Full Length:

1. Description: Fabricated of stainless steel; exposed frame with angle shapes not less than 0.050 in (1.25 mm) (18 gage) thick, with square corners mitered, welded, and ground smooth, and to accommodate glass edge protection material; with galvanized steel backing sheet, minimum 0.034 in (0.8 mm) (22 gage) in thick and full mirror size, with non-absorptive filler material (corrugated cardboard not acceptable), and with hanging brackets; glass mirror.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-290 2472.

D. Drawing Designation R4 - Surface-Mounted Security Mirror (Detention / Psychiatric Use):

1. Description: Fabricated of stainless steel, single piece minimum 0.050 in (1.25 mm) (18 gage) thick, with integral frame and factory-drilled holes for stainless steel tamperproof screw mounting; with bright polished finish.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-942.

E. Drawing Designation R5 - Surface-Mounted Fixed-Tilt Mirror:

1. Description: Fabricated of stainless steel, exposed frame, tapered not less than 3 in (75 mm) top to bottom, with angle shapes not less than 0.050 in (1.25 mm) (18 gage) thick, with square corners mitered, welded, and ground smooth, and to accommodate glass edge protection material; with galvanized steel backing sheet, minimum 0.034 in (0.8 mm) (22 gage) in thick and full mirror size, with non-absorptive filler material (corrugated cardboard not acceptable); glass mirror.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-293 2436.

F. Drawing Designation R6 - Surface-Mounted Adjustable-Tilt Mirror:

1. Description: Fabricated of stainless steel, exposed frame with angle shapes not less than 0.050 in (1.25 mm) (18 gage) thick, with square corners mitered, welded, and ground smooth, and to accommodate glass edge protection material; with galvanized steel backing sheet, minimum 0.034 in (0.8 mm) (22 gage) in thick and full mirror size, with non-absorptive filler material (corrugated cardboard not acceptable), with continuous, stainless steel piano hinge at bottom of unit and adjustable elbow hinge at each side to allow pivoting from vertical to not less than 6 in (150 mm) outward at top, and with hanging brackets; glass mirror.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-294 1630.

G. Drawing Designation R7 - Surface-Mounted Frameless Stainless Steel Security Mirror (Detention / Psychiatric Use):

1. Description: Fabricated of stainless steel, hand-selected, and stretcher leveled, with return edges, bonded to 1/4 in (6 mm) thick tempered hardboard backing; with bright polished finish.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-1556 2436.

H. Drawing Designation R8 - Recess-Mounted Medicine Cabinet:

1. Description: Fabricated of stainless steel; with hinged door equipped with full-length piano hinge, spring-buffered rod-type stop, door-swing cable limiter, and magnetic door

catch, concealing storage cabinet faced with glass mirror; with minimum three adjustable shelves with roll-formed edges; for nominal 4 in (100 mm) wall depth.

2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-398.

I. Drawing Designation S1 - Unframed Mirror: Refer to Division 08 Section "Unframed Mirrored Glazing".

2.22 TOWEL BARS AND PINS

A. Drawing Designation T1 - Surface-Mounted Extra-Heavy-Duty Towel Bar:

1. Description: Fabricated of stainless steel tube; with minimum 0.050 in (1.25 mm) (18 gage) wall thickness and 1 in (25 mm) outside diameter, with 1-1/2 in (38 mm) clearance between wall surface and inside face of bar; concealed flanged steel plate welded to end of bar, as required by mounting condition, with cover anchored with set-screws; engineered to support minimum 300 lbs (136 kg).
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-530 X 24.

B. Drawing Designation U1 - Surface-Mounted Towel Pin:

1. Description: Fabricated of stainless steel; rectangular profiled pin welded to backplate, with cover anchored with set-screws; project nominal 3-1/2 in (112 mm) from wall surface.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-6777.

C. Drawing Designation U2 - Surface-Mounted Vandal-Resistant Clothes Hook (Psychiatric Use):

1. Description: Fabricated of minimum 0.078 in (1.9 mm) (14 gage) thick stainless steel faceplate cover anchored with tamper-resistant screws; project nominal 2-1/8 in (112 mm) from wall surface, minimum 4 in (100 mm) wide by 4 in (100 mm) high; with stainless steel hook that snaps down when heavily loaded.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-983.

2.23 ROBE HOOKS

A. Drawing Designation V1 - Surface-Mounted Single Robe Hook:

1. Description: Fabricated of stainless steel; rectangular profiled pin welded to backplate, with cover anchored with set-screws; project nominal 1-1/2 in (38 mm) from wall surface.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-76717.

B. Drawing Designation V2 - Surface-Mounted Double Robe Hook:

1. Description: Fabricated of stainless steel; rectangular profiled pin welded to backplate, with cover anchored with set-screws; project nominal 2 in (50 mm) from wall surface.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-76727.

2.24 MISCELLANEOUS ACCESSORIES

A. Drawing Designation W1 - Recessed-Mounted Glove Dispenser:

1. Description: Fabricated of stainless steel; with hinged front with returned edges, equipped with full length stainless steel piano hinge and tumbler lock; with spacers to fit various size glove boxes.
2. Basis of Design: GAMCO - General Accessory Manufacturing Co. Model RGD-1.

B. Drawing Designation X1 - Through-Wall Mounted Specimen Pass-Thru Cabinet:

1. Description: Fabricated of stainless steel; cabinet interior to cover wall edges; with spring-loaded hinged doors, equipped with full length stainless steel piano hinge,

interlocking mechanism preventing both doors from being open at same time, cast aluminum pull knob; with removable stainless steel tray.

2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-50516.

C. Drawing Designation Y1 - Semi-Recessed-Mounted Hand Dryer:

1. Description: One-piece cast iron outer case, minimum 1/8 in (3 mm) thick, finished with multi-coat vitreous enamel with fused graphic operating instructions; rust resistant steel recessed mounting box; UL listed; minimum 1/10 horsepower motor on resilient mountings, sealed or self-lubricating bearings, automatic thermal overload switch; dynamically balanced, single-inlet centrifugal fan directing air through heating element to two-position, self-returning, chrome-plated air-outlet nozzle; cast aluminum base incorporating concealed, vandal-resistant air-inlet vanes; electronic sensor automatically turning dryer on when hands cross path of sensor and shutting off when hands are either removed or dryer operates for maximum 90 seconds; project maximum 4 in (100 mm) from wall surface; voltage indicated on Electrical Drawings.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-750 - white.

D. Drawing Designation Y2 - Semi-Recessed-Mounted High-Speed Hand Dryer:

1. Description: One-piece rust-resistant zinc alloy outer case with finish as selected, with graphic operating instructions attached; minimum 5/8 horsepower motor on resilient mountings, sealed or self-lubricating bearings, thermally protected; dynamically balanced, single-inlet centrifugal fan directing air, minimum 135 deg F. (57 deg C) at 72 deg F. (22 deg C) ambient temperature at 16,000 lin ft/min (4.9 km/min), through coiled nickel-chrome heating element, mounted in ceramic frame, to chrome-plated air-outlet nozzle; electronic infrared optical sensor automatically turning dryer on when hands cross path of sensor and shutting off when hands are either removed or dryer operates for maximum 35 seconds; voltage indicated on Electrical Drawings.
2. Recessed Wall Box: Fabricated of stainless steel, exposed frame with angle shapes of minimum 0.034 in (0.8 mm) (22 gage) box with 0.0625 in (1.6 mm) (16 gage) mounting plate, with square corners mitered, welded, and ground smooth, of depth required to meet ADA Protrusion Requirement of 4 in (100 mm) from face of wall.
3. Basis of Design: Excel Dryer, Inc. "XLerator" Model XL Series; color as selected by Architect from full range of available colors.

E. Drawing Designation Y3 - Surface-Mounted Hand Dryer:

1. Surface mounted and ADA compliant vandal resistant hand dryer manufactured with one-piece 1/16 inch (1.5 mm) thick stainless steel cover, satin finish, and fixed to the base by means of vandal-proof lock screws and lock. Aluminum back base with provisions for wall mounting, including silent-blocks to dampen mechanical vibrations. Unit activated through infrared electronic sensor with safety thermal cut-off. Airflow to be adjusted from 43 to 70 CFM with an air temperature from 103 to 111 degrees F (39 to 44 degrees C) and with and air velocity from 4.920 to 9.840 LFM during user controlled drying cycle. Noise level to be 64-70 dB at 79 inches distances.
2. Basis of Design: Saniflow Corporation, div of Mediclinics; Speedflow Stainless Steel Bright Finish, model M06AC-UL.

F. Drawing Designation Z1 - Surface-Mounted Retractable Clothes Line:

1. Description: Fabricated of stainless steel; with minimum 6 ft (1.8 m) long, retractable, spring-actuated synthetic clothesline and remote retention bracket.
2. Basis of Design: Gamco, A Division of Bobrick Washroom Equipment, Inc. Model B-7636.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, install toilet accessories according to the following, unless otherwise specified in this Section:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. General Requirements: Install toilet accessories level, plumb, and firmly anchored in locations and at heights indicated. Use fasteners that are appropriate to substrate indicated and as recommended by respective product manufacturer.

B. Grab Bars: Install to withstand downward load of minimum 250 lbf (1.10 kN) according to ASTM F 446.

C. Accessories within Shower and Tub Alcoves: Set flanges of accessories in sealant, install sealant in screw holes prior setting screws, and cover screw head prior to snapping on cover, to prevent water infiltration.

D. Mirrors: Secure to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 102819
SHOWER DOORS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom shower enclosures and doors and supplementary items necessary to complete their installation.

B. Refer to Interior Design Documents and Schedules for additional information.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for shower doors and enclosures.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Show locations of cutouts for enclosure-mounted accessories.
2. Show locations of reinforcements for enclosure-mounted grab bars.
3. Show locations of centerlines of drains.
4. Show overhead support or bracing locations if applicable.

C. Samples for Verification: For tub and shower doors and enclosures.

1. Each type of mounting and operating hardware; full size.
2. Glass and glazing; 12 in (300 mm) square.
3. Trim; 12 in (300 mm) lengths.

D. Product Schedule: For tub and shower doors and enclosures. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tub and shower doors and enclosures to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic

effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
    a. Show typical components, attachments to building structure, and requirements of installation.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

C. Regulatory Requirements: Comply with applicable provisions for shower enclosures and doors designated as accessible.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:
    a. Architect.
    b. Contractor, including superintendent.
    c. Installer, including project manager and supervisor.
    d. If requested, Manufacturer's qualified technical representative.
    e. Installers of other construction interfaced with Work.
2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:
    a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
    b. Review Contract Document requirements.
    c. Review approved submittals.
    d. Review inspection and testing requirements.
    e. Review environmental conditions and procedures for coping with unfavorable conditions.
    f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
3. Record discussions, including decisions and agreements, and prepare report.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 2 years from date of Substantial Completion

B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. C.R. Laurence Company Inc.
2. Kohler
3. US Horizon

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. As scheduled or indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 ENCLOSURES

A. Glass panels with mounting and operating hardware of types and sizes required to support imposed loads.

B. Hardware and Trim: Manufacturer's standard units as indicated and as required for complete installation.

1. Materials:

a. Stainless Steel:

1) Finish: No. 4 directional satin finish.

C. Swinging Doors: Hinged for 90 degrees out swing. Self-centering when doors are within 15 degrees of closed position. Soft bulb seal or wipes; affixed to door to direct water back into enclosure and provide a tight water seal.

1. Hinges: As indicated on Drawings.
2. Door Pulls: As indicated on Drawings.

D. Fixed Panels: Mounts as indicated on Drawings; match hinges in material and finish.

E. Glazing: Safety glazing materials complying with 16 CFR 1201, Category II, with permanently etched identification acceptable to authorities having jurisdiction. Refer to Division 8 Section, "Glazing" for additional requirements.

1. Clear Glass: ASTM C 1048, Type I, Quality-Q3, Class I (clear), Kind HS or Kind FT as indicated below.
2. Shower Glass Type: Heat strengthened laminated, 3/8 in (10 mm) nominal.

a. Interlayer: PVB or SentryGlas Ionoplast, Clear, 0.030 in (.75 mm) as recommended by laminate manufacturer for this application.

3. Shower Glass Type: Tempered, 3/8 in (10 mm) nominal, unless indicated otherwise on Drawings.
4. Protective, Self-Cleaning, Glass Coating: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.

F. Sealant: Mildew-resistant, single-component, nonsag, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Color: Transparent.

G. Materials:

1. Stainless-Steel Sheet: ASTM A 666, Type 302 or 304.
2. Stainless-Steel Bars and Shapes: ASTM A 276, Type 302 or 304.

2.4 ACCESSORIES

A. Fasteners for Anchoring to Other Construction: Stainless steel, select fasteners of type, grade, and class required to produce connections suitable for anchoring shower enclosures and doors to other types of construction indicated and capable of withstanding loads.

B. Fasteners for Interconnecting Components: Stainless steel, use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

2.5 SHOWER RECEPTORS

A. Refer to Division 9 Section "Tiling".

2.6 FABRICATION

A. Assemble shower enclosures and doors in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Mechanical Connections: Fabricate shower enclosures and doors by connecting members with manufacturer's standard mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

C. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

D. Door Sizes and Swings: Unless otherwise indicated, provide 24 in (600 mm) wide, in-swinging doors for standard shower enclosure, and 36 in (900 mm) wide, out-swinging doors with a minimum 32 in (800 mm) wide, clear opening for enclosures designated as accessible.

E. Glass Panels: Cut tempered glass to final size and shape before heat treatment; provide for proper edge clearance and bite on glass. Provide thickness indicated, but not less than required to support loads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Prepare and install as recommended in manufacturer's written instructions unless more stringent requirements are contained in GANA's "Glazing Manual."

B. Clean substrates, removing projections, filling voids, and sealing joints.

C. Set units level, plumb, and true to line, without warp or rack of frames and panels, and anchor securely in place.

D. Fasten components securely in place, with provisions for thermal movement. Install with concealed fasteners unless otherwise indicated.

E. Install components to drain and return water to shower.

F. Install doors to produce smooth operation and tight fit at contact points.

G. Repair, refinish, or replace components damaged during installation.

3.5 ADJUSTING AND CLEANING

A. Adjust operating parts and hardware for smooth, quiet operation and watertight closure. Lubricate hardware and moving parts.

B. Remove nonpermanent labels, and clean surfaces immediately after installation.

3.6 SHOWER DOOR AND ENCLOSURE HARDWARE SCHEDULE

A. Refer to Drawings for hardware and accessories.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 104400
FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes fire protection specialties (fire extinguishers, cabinets, accessories) and supplementary items necessary to complete their installation.

B. Cabinets for fire protection standpipe and hose systems are specified in Division 21.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Fire Extinguishers: Include rating and classification.
3. Cabinets: Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction..

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed cabinet finish required, prepared on 6 in (150 mm) by 6 in (150 mm) square, of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

C. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. J. L. Industries, Inc.; a division of Activar Construction Products Group.
2. Larsen's Manufacturing Company.
3. Potter Roemer LLC.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.4 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and mounting bracket indicated.

B. Multipurpose Dry Chemical Type(Typical Unless Otherwise Indicated or Specified): UL-rated 2A:10B:C, 5-lb nominal capacity, in enameled steel container.

C. Multipurpose Dry Chemical Type, Low Profile: UL-rated 4A:80B:C, 10-lb nominal capacity, in enameled steel container.

1. Basis of Design: Orbit; Low Profile Multi-Purpose Dry Chemical Fire Extinguisher.

D. Wet-Chemical Type for Use at Kitchens: UL-rated 2A:K, 1.6-gal. (6-L) nominal capacity, with potassium acetate, citrate, or carbonate or in combination-based chemical in stainless-steel container; with pressure-indicating gage.

E. Multipurpose Dry Chemical Type; Non-Magnetic Container: UL-rated 2A:10B:C, 5-lb nominal capacity, in enameled aluminum or stainless steel container.

F. Multipurpose Dry Chemical Type for Use at Parking Garages: UL-rated 4A:60B:C, 10-lb nominal capacity, in enameled steel container.

G. Clean-Agent Type: UL-rated 2-A:10-B:C, 14-lb (6.4-kg) nominal capacity, with HFC blend agent and inert material in enameled-steel container; with pressure-indicating gage.

2.5 FIRE-PROTECTION CABINETS

A. Fire-Protection Cabinet, General: Provide manufacturer's standard cabinet suitable for each cabinet type, trim style, hardware and door style indicated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- (1.09-mm-) thick cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.
2. Cabinet Capacity: Suitable for 10 lb. Fire extinguisher.

B. Cabinet Material:

1. Cold-rolled steel sheet.
2. Aluminum sheet.
3. Stainless steel sheet.

C. Recessed Cabinets:

1. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.

a. Flat Trim: 1/4 in (6 mm) to 5/16 in (8 mm) backbend depth (backbend)

2. Mounting:

a. Recessed - FRFEC: Recess cabinets in walls of sufficient depth to suit style of trim indicated.

1) Basis of Design: JL Industries; Embassy Series, fully recessed, trimless, custom color, S21-Solid Door, recessed pull.

b. Recessed, Low Profile - FRFEC-LP: Recess cabinets in walls of sufficient depth to suit style of trim indicated, 3.25 inches cabinet depth.

1) Basis of Design: J. L. Industries; Fire Rated Extinguisher Cabinet for Orbit Low Profile Extinguishers.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
2. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.
3. Rolled-Edge Trim: 4-inch (102-mm) backbend depth.
4. Mounting:

a. Semi-recessed Cabinet - SRFEC: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1) Basis of Design: JL Industries; Academy Series; semi recessed, white powder coat, V-Door Style “Vertical Duo" with pull.

E. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

1. Mounting:

a. Surface-Mounted - SMFEC: Surface-mounted cabinet with box fully exposed and mounted directly on wall. Provide where indicated to be surface mounted.

1) Basis of Design: JL Industries; Academy Series, surface mounted, square edge, white powder coat, V-Door Style “Vertical Duo" with pull.

F. Cabinet Trim: Same metal and finish as door.

G. Door Material:

1. Steel sheet.
2. Aluminum sheet or extruded aluminum.
3. Stainless steel sheet.
4. Copper-alloy brass sheet.
5. Copper-alloy bronze sheet.

H. Door Style: Manufacturer's standard vertical duo panel with frame.

I. Door Glazing: Tempered float glass (clear)

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch or projecting door pull and friction latch.
2. Provide continuous hinge, of same material and finish as trim or concealed hinge, permitting door to open 180 degrees.

K. ACCESSORIES

1. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish. Provide brackets for extinguishers not located in cabinets.
2. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as directed by Architect.

a. Bracket-Mounted Extinguishers: Identify with the words "FIRE EXTINGUISHER", decals in red applied to wall surface.
b. Fire Extinguisher Cabinet: Identify with the words "FIRE EXTINGUISHER", Silk-screened or Pressure-sensitive vinyl letters in black applied to door.

L. MATERIALS:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel or polyester powder coat.
b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Color: As selected by Architect from manufacturer's full range

2. Aluminum: ASTM B221 (ASTM B221M) for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.

a. Finish: Clear anodic or Color anodic.
b. Color: As selected by Architect from full range of industry colors and color densities.

3. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.

a. Finish: ASTM A480/A480M No. 4 directional satin finish

4. Copper Alloy, Brass: ASTM B36/B36M alloy [as standard with manufacturer

a. Finish: As selected by Architect from full range of industry finishes

5. Copper Alloy, Bronze: ASTM B36/B36M alloy as standard with manufacturer
   a. Finish: As selected by Architect from full range of industry finishes
6. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick

2.6 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Miter corners and grind smooth.
   3. Provide factory-drilled mounting holes.
   4. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
   2. Fabricate door frames of one-piece construction with edges flanged.
   3. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine walls and partitions for suitable framing depth and blocking where recessed or semirecessed cabinets will be installed

C. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing fire-protection specialties. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification:

1. Bracket-Mounted Extinguishers: Apply decals at locations indicated
2. Fire Extinguisher Cabinet: Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete

3.5 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 104450
AUTOMATED EXTERNAL DEFIBRILLATORS (AED)

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes cabinets and devices for automated external defibrillators (AED) and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTAL

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for AED devices and cabinets.

1. AED Devices: Include manufacturer, model and rating information.
2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Samples for Verification: For each type of exposed cabinet finish required, prepared on 6 by 6 in (150 by 150 mm) square samples and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued. That all components meet the requirements of the specifications and are acceptable to the authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Source Limitations: Obtain AED devices and cabinets through one source from a single manufacturer.

C. Regulatory Approval: Approved by the United States FDA and acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.6 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to the following:
2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion.

B. Battery Replacement: Warranty shall include replacement of batteries that fail within the manufacturer's printed battery life warranty.

C. Accessories: Manufacturer standard warranty for accessories.

D. Extension of Warranty: Provide Owner with the option to purchase extended warranty on devices beyond the manufacturer standard warranty on all components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Philips Healthcare; Heartstart Onsite AED.
2. Cardiac Science; Powerheart G3 Plus AED.
3. Defibtech; Lifeline AED.
4. ZOLL Medical Corporation; AED Plus.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 1008/A 1008M, commercial quality, stretcher leveled, temper rolled.

2.3 AED DEVICES

A. Automated External Defibrillators: Portable devices capable of detecting cardiac arrhythmias and if necessary delivering automatic synchronized shock to victims of sudden cardiac arrest with the following minimum features:

1. Design Standards: Meet the applicable requirements of UL 2601, AAMI DF-39, IEC 601-2-4, EN60601-1, IEC60601-1-2.
2. Device Classification: Class II and internally powered per EN60601-1.
3. Display written instructions to user through the rescue process.
4. Battery status indicator.
5. Automated synchronization features.
6. Programmable.
7. Pacemaker pulse detection feature.
8. Pediatric capability.
9. User replaceable batteries.

2.4 AED CABINETS

A. Cabinet Construction: Provide manufacturer's standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

B. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.

1. Construct fire-rated cabinets with double walls fabricated from 0.0478 in (1.2 mm) thick, cold-rolled steel sheet lined with minimum 5/8 in (15 mm) thick, fire-barrier material.
2. Provide factory-drilled mounting holes.

C. Cabinet:

1. Material: Steel sheet.
2. Mounting: Semi Recessed Cabinet: Recess cabinets in walls of sufficient depth to suit style of trim indicated.
3. Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth. Same metal and finish as door.

a. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Rolled-Edge Trim: backbend depth as standard with the manufacturer, but not exceeding 2 in (50mm).

4. Door Material: Steel sheet.
5. Door Glazing: Manufacturer's standard tempered float glass (clear).
6. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected. Provide minimum 1/2 in (12 mm) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.
7. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

2.5 ACCESSORIES

A. Signage and Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Standard industry accepted signs must mark the location of the AED.

B. Alarm: If required by the authorities having jurisdiction, provide strobes and local audible alarm at each location. Provide all electrical rough-in required and coordinate all electrical requirements for strobes and alarms.

C. Cabinet Label: "EMERGENCY DEFIBRILLATOR".

2.6 AED CHARGING STATION

A. Provide at least one charging station compatible with AED device rechargeable batteries.

2.7 GENERAL FINISH REQUIREMENTS, AED CABINETS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of emergency equipment cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STEEL FINISHES, AED CABINETS

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified.

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
2. Fasten cabinets to structure, square and plumb.

3.5 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 105113
METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes metal lockers and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance for each type of locker and bench.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work

1. Show locker fillers, trim, base, tops, and accessories. Include locker-numbering sequence.

C. Samples for Verification: For each locker color selected, in manufacturer's standard size samples, but not less than 4 inch square, showing the full range of color, texture, and pattern variations expected. Prepare Samples from the same material to be used for the Work.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Regulatory Requirements: Unless otherwise indicated, at least 5 percent but no less than one of each type of lockers shall comply with accessibility requirements, of the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).

1. Provide not less than one shelf located within required reach ranges.
2. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Art Metal Products; Standard K.D. Lockers.
2. ASI Storage Solutions Inc.; Traditional Collection.
3. DeBourgh Mfg. Co.; Worley Lockers.
4. List Industries Inc.; Classic Line of Superior KD Lockers.
5. Lyon Workspace Products, LLC; Standard Lockers.
6. Penco Products, Inc.; Vanguard Lockers.
7. Republic Storage Systems Company; Standard Lockers.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 366, matte finish, suitable for exposed applications, and stretcher leveled or roller leveled to stretcher-leveled flatness.

B. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

2.4 WARDROBE LOCKERS

A. Body: Form backs, tops, bottoms, sides, and intermediate partitions from 0.0239 inch (24 gage) minimum steel sheet; flanged for double thickness at back vertical corners.

B. Frames: Form channel frames from minimum 0.0598-inch- thick steel sheet; lapped and welded at corners. Form continuous integral door strike on vertical frame members. Provide resilient bumpers to cushion door closing.

1. Latch Hooks: Form from minimum 0.1046-inch- thick steel; welded or riveted to door frames.
2. Cross Frames for Multi-Tier Lockers: Form intermediate channel cross frames between tiers from minimum 0.0598-inch- (1.50-mm-) thick steel sheet. Weld to vertical frame members.

C. Doors: One-piece 0.0598 inch (16 gage) minimum steel sheet, formed into channel shape at vertical edges and flanged at right angles at top and bottom edges. Fabricate to prevent springing when opening or closing, and to swing 180 degrees.

1. Reinforcement: Brace or reinforce inner face of doors more than 15 inches wide.
2. Acoustical Treatment: Fabricate lockers for quiet operation with manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact.

3. Louvered Vents: Stamped, louvered vents in door face, as follows:

   a. Single-Tier Lockers: No fewer than six louver openings at top and bottom.
   b. Double-Tier Lockers: No fewer than three louver openings at top and bottom.
   c. Multiple-Tier Lockers: No fewer than two louver openings at top and bottom, or three louver openings at top or bottom.

D. Shelves: Provide hat shelf in single-tier units; fabricated from minimum 0.0239-inch- thick, formed steel sheet; flanged on all edges.

E. Hinges: Steel, full loop, five or seven knuckle; tight pin; minimum 2 inches high. Weld to inside of door frame and attach to door with at least two factory-installed fasteners that are completely concealed and tamper resistant when door is closed.

1. Provide at least three hinges for each door more than 42 inches high and at least two hinges for each door 42 inches high or less.

F. Recessed Handle and Latch: Manufacturer's standard housing, formed from 0.0359-inch- thick nickel-plated steel or stainless steel, with integral door pull, recessed for latch lifter and locking devices; nonprotruding latch lifter; and automatic, prelocking, pry-resistant latch, as follows:

1. Provide minimum three-point latching for each door more than 42 inches high; minimum two-point latching for each door 42 inches high or less.

   a. Provide strike and eye for padlock.

2.5 BUILT-IN LOCKS

A. Fabricate lockers to receive the following locking devices, installed on lockers using security-type fasteners:

1. Key Locks: Built-in flush locks with five-pin tumbler keyway, keyed separately and master keyed. Furnish two cut keys for each lock and five cut master keys. Comply with the following:

   a. Key Type: Grooved.
   b. Bolt Operation: Manually locking dead bolt or automatically locking spring bolt, as standard with manufacturer.

2. Combination Locks: Built-in key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key. Comply with the following:

   a. Bolt Operation: Manually locking dead bolt or automatically locking spring bolt, as standard with manufacturer.

2.6 LOCKER ACCESSORIES

A. Interior Equipment: Furnish each locker with the following items, unless otherwise indicated:

1. Hooks: Manufacturer's standard zinc-plated, ball-pointed steel. Provide one double-prong ceiling hook, and not fewer than two single-prong wall hooks for single-, double-, and triple-tier units. Attach hooks with at least two fasteners.
2. Coat Rods: Manufacturer's standard galvanized steel. Provide rod in lieu of ceiling hook for lockers 18 inches deep or greater.

B. Number Plates: Manufacturer's standard etched, embossed, or stamped, aluminum number plates with numerals at least 3/8 inch high. Number lockers in sequence indicated. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

C. Continuous Metal Base: Minimum 0.0598-inch- (16 gage) thick steel sheet, 6 inch high channel or zee profiled for stiffness, fabricated in lengths as long as practicable to enclose base and base ends of lockers, and finished to match lockers.

D. Continuously Sloping Tops for Non-Recessed Units: Manufacturer's standard, fabricated from minimum 0.0359-inch- (20 gage) thick steel sheet, for installation over lockers with separate flat tops. Fabricate tops in lengths as long as practicable, without visible fasteners at splice locations, finished to match lockers. Provide fasteners, filler plates, supports, and vertical end closures.

E. Recess Trim for Recessed Units: Manufacturer's standard; fabricated from minimum 0.0478-inch- (18 gage) thick steel sheet, minimum 2-1/2-inch face width, and finished to match lockers. Fabricate trim in lengths as long as practicable.

F. Filler Panels: Manufacturer's standard; fabricated from minimum 0.0478-inch- (18 gage) thick steel sheet in an unequal leg angle shape, and finished to match lockers. Provide slip joint filler angle formed to receive filler panel.

G. Finished End Panels for Non-Recessed Units: Manufacturer's standard; fabricated from minimum 0.0239-inch- (24 gage) thick steel sheet, finished to match lockers, and designed for concealing exposed ends of nonrecessed lockers.

2.7 LOCKER BENCHES

A. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges, of the following material; minimum 9-1/2 inches wide by 1-1/4 inches thick (241 mm wide by 32 mm thick) except provide minimum 20-inch- (508-mm-) wide tops where accessible benches are indicated.

1. Laminated Maple: Laminated maple with one coat of clear sealer on all surfaces, and one coat of clear lacquer on top and sides.
2. Plastic Laminate: Plastic laminate over medium-density particleboard core, with two steel tubes running full length of top and positioned to receive pedestal fasteners.
3. Extruded Aluminum: Extruded aluminum with anodized finish.

B. Pedestals: Provide manufacturer's standard pedestal supports, with predrilled fastener holes, complete with fasteners and anchors, and as follows:

1. Fixed Type: Tubular steel, minimum 1-1/4-inch diameter, with minimum 0.1345-inch-thick steel flanges welded at top and base, and baked-enamel finish; floor anchored with exposed fasteners.
2. Freestanding Type: Aluminum, 1/8-inch-thick by 3-inch-wide channel or 1/4-inch-thick by 3-inch-wide bar stock, shaped in a trapezoidal form, with nonskid pads at bottom of each leg; freestanding.
3. Color: Match locker units.

C. Furnish a minimum of two pedestals for each bench, with pedestal spacing not more than 72 inches o.c.

2.8 FABRICATION

A. Unit Principle: Fabricate each locker with an individual door and frame, individual top, bottom, back, and shelves, and common intermediate uprights separating compartments.

B. Knocked-Down Construction: Fabricate lockers for nominal assembly at Project site.

C. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch. Weld frame members together to form a rigid, one-piece assembly.

1. Form locker-body panels, doors, shelves and accessories from one-piece steel sheet, unless otherwise indicated.

2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 1.4 mils on doors, frames, and legs, and 1.1 mils elsewhere.

1. Color and Gloss: As scheduled or as indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Install metal lockers and accessories level, plumb, rigid, and flush according to manufacturer's written instructions.

B. Assemble knocked-down lockers with standard fasteners, with no exposed fasteners on door faces and face frames.

C. Anchor lockers to floors and walls at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

D. Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Recessed Units:

a. Attach recess trim to recessed lockers with concealed clips.

2. Non-Recessed Units:

a. Attach sloping top units to lockers, with closures at exposed ends.
b. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of non-recessed lockers.

E. Fixed Locker Benches: Anchor locker benches to floor. Uniformly space pedestals not more than 72 inches apart and securely fasten to bench top and anchor to floor.

F. Freestanding Locker Benches: Place benches in locations indicated on Drawings.

3.5 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Clean interior and exposed exterior surfaces and polish stainless-steel and nonferrous-metal surfaces.

C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

D. Touch up marred finishes, or replace locker units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

3.6 LOCKER SCHEDULE

A. Refer to the drawings.

3.7 FINISH SCHEDULE

A. Locker Color and Gloss: As selected by Architect from manufacturer's full range of colors.

B. Locker Color and Gloss:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 105116
WOOD LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wood lockers and supplementary items necessary to complete their installation.

1. Wood-faced wood lockers.
2. Plastic-laminate-clad wood lockers.
3. Locker benches.

1.2 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wood locker, and bench if applicable.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include plans, elevations, sections, and attachment details.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for items installed in lockers.
4. Show locker fillers, trim, base, sloping tops, and accessories.
5. Show locker identification system and numbering sequence.

C. Samples for Verification: For the following products:

1. Wood-faced panels with transparent finish, not less than 8 by 10 inches (203 by 254 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.
2. Wood members and panels with factory-applied painted finish, not less than 50 sq. in. (300 sq. cm) for wood members and 8 by 10 inches (203 by 254 mm) for panels, for each finish system and color, with exposed surface finished.
3. Plastic-laminate-clad panels, not less than 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish.
4. Thermoset decorative-overlay-surfaced panels, not less than 8 by 10 inches (203 by 254 mm), for each type, color, pattern, and surface finish.
5. Corner pieces of locker front frame joints between stiles and rail, as well as exposed end pieces, not less than 18 inches wide by 18 inches high by 6 inches deep (457 mm wide by 457 mm high by 152 mm deep).
6. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Materials: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wood locker doors, complete with specified door hardware.

a. Furnish quantity of doors for each type and color installed as determined by Owner.

2. Units of the following locker hardware items equal to 10 percent of amount installed for each type and finish installed:

a. Hinges.
b. Pulls.
c. Locks.
d. Blank identification plates.
e. Hooks.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.

B. Quality Standard: Unless otherwise indicated, comply with "Architectural Woodwork Standards" for standards and for grades of interior architectural woodwork indicated for construction, finish, installation, and other requirements:

1. Provide manufacturer certification indicating that woodwork complies with requirements of referenced quality standards.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.

a. Show typical components, attachments to building structure, and requirements of installation.
b. Build mockup of typical corner, including one locker on each side of corner and corner filler, including door panel with specified door hardware, as shown on Drawings

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.

5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until painting and similar operations that could damage lockers have been completed in installation areas. If lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are the same as those in final installation location and comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer’s recommendations for optimum temperature and humidity conditions during storage and installation. Do not deliver or install wood lockers until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity during the remainder of the construction period.

B. Field Measurements: Where lockers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support lockers by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where wood lockers are indicated to fit to other construction, establish dimensions for areas where lockers are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate sizes and locations of concealed wood support bases.

C. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that wood lockers can be supported and installed as indicated.

1.11 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required. These include, but are not limited to, the following:

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of locks and other hardware.
c. Deterioration of wood, wood finishes, and other materials beyond normal use.

2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Classic Woodworking LLC
2. Hollman, Inc.
3. Ideal Products, Inc.
4. Legacy Lockers.
5. Treeforms, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: Comply with applicable provisions in the ADA Accessibility Standards, ABA Accessibility Standards, and the Building Code.

2.3 WOOD-FACED WOOD LOCKERS

A. Construction Style: Flush overlay unless indicated otherwise.

1. Configuration: As selected by Architect from manufacturer™™s full range of standard configurations.

B. Final Assembly: Manufacturer's standard factory assembly.

C. Locker Body: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay.

1. Side Panels: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
2. Back Panel: Manufacturer's standard 1/2 or 3/8 inch (13 or 9.5 mm) thick.
3. Top Panel: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
4. Bottom Panel: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
5. Exposed Panel Edges: 3-mm-thick PVC.

D. Flush, Solid-Wood Doors: 3/4-inch- (19-mm-) thick, solid wood; end and edge glued.

1. Species and Cut: As scheduled or indicated in Design Selections.

E. Raised-Panel, Solid-Wood Doors: 3/4-inch- (19-mm-) thick, solid-wood stiles and rails with 3/4-inch- (19-mm-) thick, solid-wood center panels. Fabricated to allow center panel movement.

1. Species and Cut: As scheduled or indicated in Design Selections.

F. Flush, Wood-Faced Doors: Wood veneer applied over 3/4-inch- (19-mm-) thick, medium-density-fiberboard or hardwood-plywood core.

1. Wood Veneer: As scheduled or indicated in Design Selections.
2. Wood Edges: Solid wood of same wood species as face veneer.

G. Louver Wood Doors: Solid-wood stiles and rails, 3/4 inch (19 mm) thick, with 1/4-inch- (6-mm-) thick, angled, solid-wood louver panels fixed in position. Dowel and glue stile-and-rail joints.

1. Species and Cut: As scheduled or indicated in Design Selections.

H. End Panels: Match style, material, construction, and finish of wood-faced wood doors.

I. Shelves: Fabricated from particleboard-core panels covered on both sides with thermoset decorative overlay; fixed unless otherwise indicated.

1. Thickness: 5/8 inch (16 mm).
2. Exposed Edges: 3-mm-thick PVC.

J. Corners and Filler Panels: 3/4-inch- (19-mm-) thick panel. Match style, material, construction, and finish of wood-faced wood doors.

K. Continuous Finish Base: Where indicated, wood-faced, 3/4-inch- (19-mm-) thick panel that matches door faces; fabricated in lengths as long as practical to enclose base and base ends of lockers.

L. Continuously Sloping Tops: Where indicated, wood-faced, 3/4-inch- (19-mm-) thick panel that matches door faces for installation over lockers with separate flat tops. Fabricate tops in lengths as long as practical, without visible fasteners at splice locations. Provide fasteners, supports, and closures, as follows:

1. Closures: Hipped-end type.

M. Grain Matching: Run and match grain vertically for doors and fixed panels.

N. Veneer Matching:

1. None required unless indicated otherwise; select and arrange veneers for compatible grain and color.

O. Transparent Finish: Manufacturer's standard two-coat, clear, catalyzed lacquer finish with sanding between coats. Seal with moisture-resistant topcoat.

1. Finish: As scheduled or indicated in Design Selections, match Architect's approved sample.

P. Painted Finish: Manufacturer's standard two-coat, painted acrylic finish.

1. Finish: As scheduled or indicated in Design Selections, match Architect's approved sample.

Q. Factory finish wood lockers as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

1. Preparations for Finishing: Sand, fill countersunk fasteners, seal concealed surfaces, and perform similar preparations for finishing lockers, as applicable to each unit of the Work.
2. Back Priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood lockers that do not have finish materials applied. Apply two coats to concealed backs and ends of panels.

2.4 PLASTIC-LAMINATE-CLAD WOOD LOCKERS

A. Construction Style: Flush overlay unless indicated otherwise.

1. Configuration: As selected by Architect from manufacturer full range of standard configurations.

B. Locker Body: Fabricated from particleboard-core panels covered on both sides with high impact, abrasion resistant, thermally fused laminate overlay.

1. Side Panels: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.

2. Back Panel: Manufacturer's standard 1/2 or 3/8 inch (13 or 9.5 mm) thick.
3. Top Panel: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
4. Bottom Panel: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
5. Exposed Panel Edges: 3-mm-thick PVC.

C. Plastic-Laminate-Clad Wood Doors: High-pressure decorative laminate, Grade VGS, over both sides of particleboard core.

1. Thickness: 3/4- inch (19 mm) thick.
2. Panel Edges: 3-mm-thick PVC.

D. End Panels: Match style, material, construction, and finish of plastic-laminate-clad wood doors.

E. Shelves: Fabricated from particleboard-core panels covered on both sides with thermally fused laminate overlay; fixed unless otherwise indicated.

1. Thickness: 5/8 inch (16 mm).
2. Exposed Edges: 3-mm-thick PVC.

F. Corners and Filler Panels: 3/4-inch- (19-mm-) thick panels. Match style, material, construction, and finish of plastic-laminate-clad wood doors.

G. Continuous Finish Base: Where indicated, provide plastic-laminate-clad, 3/4-inch- (19-mm-) thick panel that matches door faces; fabricated in lengths as long as practical to enclose base and base ends of lockers.

H. Continuously Sloping Tops: Where indicated, plastic-laminate-clad, 3/4-inch- (19-mm-) thick panel that matches door faces for installation over lockers with separate flat tops. Fabricate tops in lengths as long as practical, without visible fasteners at splice locations. Provide fasteners, supports, and closures, as follows:

1. Closures: Hipped-end type.

I. Plastic-Laminate Colors, Patterns, and Finishes:

1. Finish: As scheduled or indicated in Design Selections, match Architect's approved sample.

2.5 MATERIALS

A. Solid Wood: Clear hardwood lumber, selected for compatible grain and color.

1. Species and Finish: As scheduled or as indicated in Design Selections.

B. Composite Wood: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
2. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, Grade A-1.

a. Species and Finish: As scheduled or as indicated in Design Selections.

C. High-Pressure Decorative Laminate: ISO 4586-3, grades as follows:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade VGS.

D. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

E. Anchors: Material, type, size, and finish as required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

F. Wood Support Base: 2-by-4-inch nominal-size (51-by-102-mm actual-size) lumber treated with manufacturer's standard preservative-treatment process.

2.6 HARDWARE

A. Cylinder Lock: Manufacturer standard built-in, flush cam locks with five-pin tumbler keyway, keyed separately and master keyed. Furnish two change keys for each lock and four master keys.

1. Key Type: Flat or Grooved, with minimum 2-by-2.68-inch (51-by-68.3-mm) key head for accessible lockers.
2. Bolt Operation: automatically locking spring bolt.

B. Built-in Combination Lock: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key. Provide escutcheon plate.

1. Bolt Operation: Automatically locking spring bolt.

C. Digital Keypad Lock: Battery-powered electronic keypad with reprogrammable manager and owner codes that override access. Three consecutive incorrect code entries are to disable lock for three minutes.

1. Designed for shared or temporary access by multiple users, with user-defined code to lock and unlock. Provide LED indicator to show when lock is in use.

D. Frameless Hinges (European Type): Fully concealed, self-closing, nickel-plated steel, with not less than 125 degrees of opening.

1. Provide two hinges for doors 36 inches (914 mm) high and less.
2. Provide three hinges for doors more than 36 inches (914 mm) high.

E. Wire Pulls: Back mounted; 5 inches (127 mm) long, 2-1/2 inches (62 mm) deep, and 5/16 inch (8 mm) in diameter.

F. Accessible Handle: Metal, fixed, graspable lever handle and rose trim; surface mounted.

G. Hooks: Manufacturer's standard, ball-pointed aluminum or steel; finished to match other locker hardware. Attach hooks with at least two fasteners.

1. Provide two double-prong wall hooks, for each compartment of lockers.

H. Coat Rods: 3/4-inch- (19-mm-) diameter steel; finished to match other locker hardware.

1. Provide coat rods as indicated on Drawings.

I. Exposed Hardware Finish:

1. Unless otherwise indicated, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

a. Finish: As selected by Architect from manufacturer's full range of finish options.

2.7 ACCESSORIES

A. Number Identification Plates: Etched, embossed, or stamped, recessed metal plates with black numbers and letters at least 1/2 inch (13 mm) high. Identify lockers in sequence indicated on Drawings. Finish plates to match other wood locker hardware.

1. Identification Plate Shape and Font: Circle 1-1/2-inch- (38-mm-) diameter, oval, or square 1-1/2-inch x 1-1/2-inch (38-mm x 38-mm), as selected by Architect from manufacturer's full range.

2.8 LOCKER BENCHES

A. End-Panel Locker Benches: Bench top supported between vertical end supports, as follows:

1. End Supports: 4-inch (102-mm) thickness, with height and width same as height and width of bench.

a. Finish: Match style, material, and finish of locker doors.

2. Bench Top: 3-inch- (76-mm-) thick, particleboard core. Provide 1/2-inch- (13-mm-) radius top edges on bench sides.

a. Width: 17 inches (432 mm) except provide minimum 20-inch (508-mm) width where accessible benches are indicated.
b. Height: 18 inches (457 mm) measured from top of bench to floor.
c. Length: 48 inches (1219 mm), unless indicated otherwise.
d. Finish: Match style, material, and finish of locker doors.

B. Pedestal-Leg Locker Benches: Bench top supported by pedestal legs, minimum of two pedestals for each bench, with overall height of 18 inches (457 mm) measured from top of bench to floor, as follows:

1. Metal Pedestal Legs: 1-1/2-inch- (38-mm-) square, painted steel tube.
2. Bench Tops: 1-1/4 inches (32 mm) deep; fabricated as follows:

a. Wood Top: Match style, material, and finish of locker doors.
b. Width: 17 inches (432 mm) except provide minimum 20-inch (508-mm) width where accessible benches are indicated].
c. Length: 48 inches (1219 mm), unless indicated otherwise.

2.9 FABRICATION

A. Fabricate each locker with shelves, an individual door and frame, an individual top, a bottom, and a back, and with common intermediate uprights separating compartments.

1. Fabricate lockers to dimensions, profiles, and details indicated.
2. Ease edges of corners of solid-wood members to 1/16-inch (1.5-mm) radius.

B. Fabricate lockers square, rigid, without warp, and with finished faces flat and free of dents, scratches, and chips. Accurately factory machine components for attachments. Make joints tight and true.

1. Fabricate lockers with joints that are dadoed or rabbeted, glued full length, and stapled. Dado side panels to receive shelving except where indicated to be adjustable.

C. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

D. Venting: Fabricate lockers with space between doors and locker assembly of not less than 3/4 inch (19 mm), with painted metal security screen attached to each shelf between doors.

E. Number Identification Plates: Inlay number plates flush in each locker door, near top, centered.

F. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that the parts fit as intended, and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
2. Use only manufacturer's nuts, bolts, screws, and other devices for assembly.

G. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

H. Attach PVC edging to panels by thermally fusing edging to panels after panel fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that furring is attached to concrete and masonry walls that are to receive lockers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Condition lockers to average prevailing humidity conditions in installation areas before installation.

B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Install wood support base with 1/2-inch- (13-mm-) thick, plywood top.

B. Install lockers level, plumb, and true; use concealed shims.

C. Connect groups of lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.

D. Install lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Installation Tolerance: No more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line. Shim as required with concealed shims.

E. Locker Anchorage:

1. Free Standing Lockers: Fasten lockers through wood locker base, at ends, and not more than 36 inches (910 mm) o.c. with No. 8 flush-head wood screws sized for 1-inch (25-mm) penetration into wood base.
2. Wall Mounted Lockers: Fasten lockers through back, near top and bottom, at ends with No. 8 pan-head sheet metal screws through metal backing or metal framing behind wall finish and spaced not more than 16 inches (400 mm) o.c.

F. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.

G. Attach sloping-top units to lockers, with end panels covering exposed ends.

H. Install identification plates after lockers are in place.

1. Attach number identification plate on each locker door, near top, centered, with at least two screws with finish matching the plate.

I. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches (1830 mm) apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.4 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

3.5 PROTECTION

A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes or replace lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 111300
LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes loading dock equipment and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

A. Product Data: Include accessories, details of construction relative to materials, dimensions of individual components, profiles, and finishes.

1. Dock Leveler: Include rated capacities for each unit.
2. Dock Lift: Include rated capacities for each unit.

B. Shop Drawings: Show details of fabrication and installation. Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts anchored to permanent construction.
2. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring for the following:

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For loading dock equipment to include in the maintenance manuals specified in Division 01. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications: Engage an experienced installer who is an authorized representative of loading dock equipment manufacturer for both installation and maintenance of the type of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

C. Dock Leveler Standard: Comply with MH 30.1, "Safety, Performance and Testing of Dock Leveling Devices." (Formerly MH 14.1)

D. Dock Lift Standard: Comply with MH 29.1, "Safety Requirements for Industrial Scissors Lifts."

E. Design Criteria: The drawings indicate sizes, profiles, and dimensional requirements of the various items of loading dock equipment and are based on the specific types and models indicated. Similar equipment by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

F. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review sequence of operation for each type of loading dock equipment.

3. Review coordination of interlocked equipment specified in this Section and elsewhere.
4. Review required testing, inspecting, and certifying procedures.

1.5 WARRANTY

A. Dock-Leveler Warranty: Submit a written warranty, executed by manufacturer, agreeing to repair or replace dock-leveler components that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures, including cracked or broken structural support members and load-bearing welds.
2. Deck plate failures, including cracked plate or permanent deformation in excess of 1/4 inch (6 mm) between deck supports.
3. Hydraulic system failures, including failure of hydraulic seals and cylinders.
4. Faulty operation of operators, control system, or hardware.

B. Warranty Period: Two years from date of Substantial Completion.

1. Warranty shall be for unlimited usage of the leveler for the specified rated capacity over the term of the warranty.

1.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of dock equipment Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper equipment operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.

1. Perform maintenance, including emergency callback service, during normal working hours.

B. Continuing Maintenance Service: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

2.2 MATERIALS, GENERAL

A. Source Limitations: Obtain each loading dock equipment component as a complete unit from one source and by a single manufacturer.

2.3 DOCK BUMPERS

A. Laminated-Tread Bumpers: Provide units of size indicated, fabricated from multiple plies cut from fabric-reinforced rubber tires to a uniform thickness of 4-1/2 in (112 mm). Laminate plies

under pressure on 3/4 in (19 mm) diameter, steel supporting rods that are welded and bolted to 1/4 in (6 mm) thick, structural-steel angle closures with predrilled anchor holes. Size angles to provide not less than 1 in (25 mm) of tread plies extending beyond the face of closure angles.

1. Height: 10 in (250 mm) unless otherwise indicated.
2. Length: 36 in (900 mm) unless otherwise indicated.

B. Anchorage Devices: Provide anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plate, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated. Hot-dip galvanize anchorage components.

C. Manufacturers:

1. Blue Giant Equipment Corporation
2. Kelley
3. McGuire
4. Pioneer Loading Dock Equipment
5. Poweramp Systems, Inc.
6. Rite-Hite Corporation
7. Serco

2.4 FOAM-PAD LOADING DOCK SEALS

A. General: Dock seals consisting of fabric-covered foam pads designed to compress 4 to 5 inches (102 to 127 mm) under pressure of truck body to form an airtight seal at jambs and head of loading dock openings; of type, size, and construction indicated.

B. Stationary Head Pad: 24 inches (610 mm) high and same depth as jamb pads; sized for opening width.

C. Jamb Pads: Square.

1. Nominal Size: 8 inches (203 mm) wide and sized for opening height.

D. Construction: Consisting of single- or double-ply, coated, fabric-covered, urethane-foam core with supporting frame. Fabricate jamb and head pads of same depth and sized for opening width.

1. Steel Support Frame: Steel channel frame of manufacturer's standard weight, shape, and finish; with steel mounting hardware.

a. Steel Finish: Hot-dip galvanize components to comply with the following:

1) ASTM A 123/A 123M for iron and steel support framing.
2) ASTM A 153/A 153M or ASTM F 2329 for iron and steel hardware and anchors.

E. Materials:

1. Cover Fabric: Manufacturer's proprietary cover fabric complying with the following minimum requirements:

a. Tearing strength of not less than 300 by 300 (1334 by 1334) lbf (N) when tested according to ASTM D 2261.
b. Abrasion resistance of not less than 6000 cycles when tested according to FED-STD-191A-5306.
c. Tensile strength of not less than 1200 by 1200 (5338 by 5338) lbf (N) when tested according to FED-STD-191A-5100.1.
d. Cold resistance to minus 40 deg F (minus 40 deg C) when tested according to FED-STD-191A-5874.

e. Color: As selected by Architect from manufacturer's full range.

1) High-Visibility Layer: Manufacturer's standard yellow or orange layer.

2.5 RECESSED DOCK LEVELERS

A. General: Provide recessed dock levelers of type, function, operation, capacity, size, and construction indicated, complete with controls, safety devices, and accessories required.

B. Type: Provide recessed, hinged-lip-type dock levelers designed for permanent installation in concrete pits, preformed in the edge of loading platform.

C. Function: Dock levelers shall compensate for differences in height between truck bed and loading platform in the following manner:

1. Vertical Travel: Minimum working range shall be 12 in (300 mm) above and 12 in (300 mm) below adjoining platform level. Provide an operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact.
2. Automatic Vertical Compensation: Floating travel of ramp with lip extended and resting on truck bed shall compensate automatically for upward or downward movement of truck bed during loading and unloading.
3. Automatic Lateral Compensation: Tilting of ramp with lip extended and resting on truck bed shall compensate automatically for canted truck beds of up to 4 in (100 mm) over width of ramp.
4. Lip Operation: Provide manufacturer's standard mechanism that automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck, and automatically retracts lip when truck departs.

   a. Length of Lip Extension: Not less than 16 in (400 mm) from ramp edge and not less than 12 in (300 mm) in front of dock bumpers.

5. Automatic Ramp Return: Provide automatic return of unloaded ramp, from raised or lowered positions to stored position, level with platform, as truck departs.

D. Operation: Provide manufacturer's standard operating system as follows:

1. Hydraulic Operating System: Provide electric hydraulic raising and hydraulic lowering of ramp, controlled from a remotely located push-button station. Equip leveler with a packaged unit including a unitized, totally enclosed, nonventilated electric motor, pump, manifold reservoir, and valve assembly of proper size, type, and operation for capacity of leveler indicated. Include means for lowering ramp below platform level with lip retracted behind dock bumpers. Provide a hydraulic velocity fuse connected to main hydraulic cylinder to limit loaded ramp's free fall to not more than 3 in (75 mm).

   a. Electrical Requirements: Coordinate wiring requirements and current characteristics with building electrical system. See Division 26 Sections.
   b. Remote-Control Station: Provide a multibutton control station with an up button of the constant-pressure type and an emergency stop button of the momentary-contact type, enclosed in a NEMA ICS 6, Type 12 box. Raise ramp by holding up button depressed, and lower ramp at a controlled rate by releasing up button. Stop all ramp movement, regardless of position of ramp or lip, by depressing stop button. Resume normal operation by a manual reset button or by pulling out stop button.
   c. Hydraulic Lip Operation: Provide electric-powered hydraulic raising and hydraulic lowering of lip, controlled independently of raising and lowering of ramp.

E. Rated Capacity: Provide dock levelers capable of supporting a total gross load indicated below without permanent deflection or distortion, as determined by actual tests complying with requirements of MH 30.1 for rated capacity.

1. Total Load: Not less than 25,000 lb (11,350 kg).

F. Safety Devices: Provide manufacturer's standard and optional safety devices as follows:

1. Toe Guards: Equip open sides of rising ramp over entire upper operating range with metal toe guards mounted flush with ramp edges and projecting below ramp.
2. Cross-Traffic Support: Provide manufacturer's standard method of supporting ramp at platform level in stored position with lip retracted. Provide a means to release supports to allow ramp to descend below platform level.
3. Maintenance Strut: Provide an integral strut to positively support ramp in up position during maintenance of dock leveler.
4. Interlocks: Provide control interlocks between dock leveler and other dock equipment as follows:

a. Leveler to Truck-Restraint Interlock: Leveler will not operate while truck restraint is not engaged.

G. Construction: Fabricate dock-leveler frame from structural- and formed-steel shapes. Fabricate platform, including hinged lip, from nonskid steel plate. Fabricate entire assembly to withstand deformation during both operating and stored phases of service. Chamfer lip edge to minimize obstructing wheels of material-handling vehicles. Include two dock bumpers attached to frame.

H. Finish and Color: Manufacturer's standard paint applied to factory-assembled and -tested dock levelers before shipping. Paint toe guards yellow to comply with ANSI Z535.1, and paint remainder of surfaces in manufacturer's standard color.

I. Manufacturers:

1. Blue Giant Equipment Corporation
2. Kelley
3. McGuire
4. Pioneer Loading Dock Equipment
5. Poweramp Systems, Inc.
6. Rite-Hite Corporation
7. Serco

2.6 TRUCK RESTRAINTS

A. General: Provide manufacturer's standard mechanical device designed to engage truck's rear-impact guard and hold truck at loading dock. Restraint shall consist of an iron or steel restraining arm that raises until contacting rear-impact guard. Arm shall move vertically, automatically adjusting to varying height of truck due to loading and unloading operations.

B. Automatic Operating System: Provide manufacturer's standard electrically or hydraulically powered restraint, activated by a remote-control station.

1. Electrical Requirements: Coordinate wiring requirements and current characteristics with building electrical system. See Division 26 Sections.
2. Remote-Control Station: Provide a single-button station of the constant-pressure type, enclosed in a NEMA ICS 6, Type 12 box. Engage restraint by holding the button depressed, and release restraint by releasing button.

C. Operating Range: Restrain rear-impact guard within a range from 11 to 30 in (275 to 750 mm) vertically above driveway, and from 0 to 12 in (0 to 300 mm) horizontally in front of dock bumpers.

D. Mounting: Provide manufacturer's standard mounting method as follows:

1. Wall Mounted: Unit with mounting plate, designed for attachment to dock face by welding or bolting.

E. Restraining Capacity: Not less than 30,000 lb (13,600 kg).

F. Communication System: Provide manufacturer's standard system, as follows:

1. Warning Signs: Set of surface-mounted signs.
2. Signal Lights: Set of illuminated exterior and interior signal lights to indicate device's status to both controller and truck driver.

a. Lights shall be activated automatically when device engages rear-impact guard.

3. Alarm: Audible and visual system indicating that rear-impact guard is not engaged.

G. Interlocks: Interconnect truck restraint with dock leveler to permit simultaneous activation of leveler and truck restraint.

H. Finish and Color: Manufacturer's standard paint applied to factory-assembled and -tested truck restraints before shipping. Paint surfaces in manufacturer's standard color.

I. Manufacturers:

1. Blue Giant Equipment Corporation
2. Kelley
3. McGuire
4. Pioneer Loading Dock Equipment
5. Poweramp Systems, Inc.
6. Rite-Hite Corporation
7. Serco

2.7 DOCK LIFTS (SCISSORS LIFTS)

A. General: Provide manufacturer's standard hydraulic dock lift of capacity, size, and construction indicated, consisting of a nonslip steel platform with beveled toe guards on all four sides, steel scissor legs, and hydraulic operating system, complete with controls, safety devices, and accessories required.

B. Type: Provide stationary single-scissors-type hydraulic dock lift designed for permanent, recessed installation in a preformed concrete pit at location indicated.

C. Rated Capacity: Provide lifting capacity of not less than 8000 lb (3600 kg) with 6500 lb (3000 kg) axle load at ends and 5000 lb (2275 kg) axle load at sides.

D. Vertical Travel: Provide maximum vertical travel of 60 in (1500 mm) from a lowered height of 12 in (300 mm) for a raised height of 72 in (1800 mm).

E. Travel Speed: Nominal raising speed of 8 fpm (0.04 m/s) to 12 fpm (0.06 m/s).

F. Construction: Fabricate lift from structural-steel shapes rigidly welded and reinforced for maximum strength, safety, and stability. Design assembly to withstand deformation during both operating and stored phases of service. Provide mounting brackets and removable lifting eyes for ease of installation.

1. Platform: Fabricate platform from heavy steel plate with beveled toe guards on all four sides to comply with requirements of MH 29.1. Provide matching, hinged, throw-over bridge where indicated and removable handrails.

   a. Platform Surface: Nonskid, safety-tread deck plate.
   b. Platform Size: 6 ft (1.8 m) wide by 10 ft (3 m) long.

2. Hinged Bridge: Provide hinged, throw-over bridge bolted to full-length, heavy-duty, piano-type hinge welded to toe guard at end of platform. Provide bridge complete with heavy-duty lifting chains. Chamfer edge of bridge to minimize obstructing wheels of material-handling vehicles.

   a. Bridge Material: Nonskid, safety-tread steel plate.
   b. Bridge Size: 18 in (450 mm) long by 6 ft (1.8 m) wide.

3. Scissors Mechanism: Fabricate leg members from heavy, steel-formed tube or plate members to provide maximum strength and rigidity.
4. Cylinders: Equip lift with not less than two heavy-duty, high-pressure, hydraulic, ram-type cylinders. Rams shall be either direct-displacement plunger or rod-and-piston type with positive internal stops as standard by manufacturer. Cylinder rods shall be chrome plated and polished to prevent rusting.
5. Bearings: Provide pivot points with permanently lubricated antifriction bushings or sealed ball bearings for minimum maintenance.

G. Operation: Provide manufacturer's standard, self-contained, electric, hydraulic power unit for raising and lowering lift, controlled from a remotely located push-button station.

1. Electrical Requirements: Coordinate wiring requirements and current characteristics with building electrical system. See Division 26 Sections.
2. Power Unit: Provide manufacturer's standard, self-contained, remotely located power unit of size, type, and operation needed for capacity of lift indicated. Power unit shall consist of a continuous-duty motor, high-pressure gear pump, valve manifold, oil-line filters, and oil reservoir.

   a. Manifold shall contain a relief valve, check valve, pressure-compensated flow-control valve and solenoid valve, and provisions for lowering lift manually if power fails.
   b. Oil-line filters shall include one for the oil reservoir, one for the valve manifold, and one for the lift itself.
   c. Rate of Descent Protection: Provide manufacturer's standard pressure compensated flow control to limit down speed.

3. Remote-Control Station: Provide a weatherproof, multibutton control station of the constant-pressure type with up and down push buttons. Controller shall consist of a magnetic motor starter with three pole-adjustable overloads and 24-V control transformer with a 4-A, fused secondary prewired to terminal strips and enclosed in a NEMA ICS 6, Type 12 box.

   a. Upper-Travel-Limit Switch: Equip unit with manufacturer's standard, adjustable, upper-travel-limit switch.

H. Safety Devices: Provide manufacturer's standard and optional safety devices as follows:

1. Removable Handrails: Provide removable handrails on two sides of platform with a single, removable chain across each end. Handrails shall be 42 in (1050 mm) high with a midrail and 4 in (100 mm) high kick plate at bottom. Mount rail sockets flush with platform surface.
2. Maintenance Leg: Provide manufacturer's standard, removable, safety maintenance leg.

3. Toe Protection: Provide manufacturer's standard toe protection along entire unprotected side of lifts.

I. Finish and Color: Manufacturer's standard paint applied to factory-assembled and -tested dock lifts before shipping. Paint toe guards yellow with black stripes to comply with ANSI Z535.1, and paint remainder of surfaces in manufacturer's standard color.

J. Manufacturers:

1. Advance Lifts, Inc.
2. Autoquip Corporation
3. Blue Giant Equipment Corporation
4. Kelley
5. Serco

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive loading dock equipment and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

B. Examine roughing-in for electrical systems for dock equipment to verify actual locations of connections before installation.

C. Examine walls and floors of pits for suitable conditions where recessed dock equipment is to be installed. Pits shall be plumb and square, and properly sloped for drainage from back to front of dock.

3.2 PREPARATION

A. General: Coordinate installation of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.

B. Clean recessed pits of debris.

3.3 INSTALLATION, GENERAL

A. General: Comply with manufacturer's detailed written instructions for installing loading dock equipment.

1. Install equipment, motor, pump, control stations and wiring, safety devices, and accessories as required for a complete installation.

B. Electrical Connections: Rough-in electrical connections according to requirements in Division 26.

3.4 DOCK-BUMPER INSTALLATION

A. Attach dock bumpers to structure in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

1. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.

3.5 INSTALLATION OF FOAM PAD LOADING DOCK SEALS

A. Attach dock-seal support frames securely to building structure in proper relation to openings, dock bumpers, and dock levelers to ensure compression of dock seals when trucks are positioned against dock bumpers.

3.6 DOCK LEVELER INSTALLATION

A. Attach leveler securely to loading platform construction according to manufacturer's written instructions, flush with adjacent dock surfaces and square to recessed pit.

B. Recessed Dock Levelers: Coordinate forming recessed pit for dock levelers to ensure that recess is adequate to accommodate leveler in proper relation to loading platform.

3.7 TRUCK RESTRAINT INSTALLATION

A. Attach truck restraints in a manner that complies with requirements for arrangement and height required for device to engage vehicle rear-impact guard.

1. Anchor restraint to dock face with expansion anchors and bolts.

B. Interconnect control panel and signals according to manufacturer's written installation instructions.

3.8 DOCK LIFT (SCISSORS LIFT) INSTALLATION

A. Coordinate forming recessed pit for dock lifts to ensure that depth is adequate to accommodate lift in proper relation to loading platform.

3.9 ADJUSTING

A. Adjust loading dock equipment for safe, efficient operation.

B. Test dock levelers and lifts for vertical travel within operating range indicated.

3.10 CLEANING AND PROTECTING

A. Restore marred, abraded surfaces to their original condition.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure loading dock equipment is without damage or deterioration at the time of Substantial Completion.

3.11 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in maintenance manuals. Refer to Division 01 Section "Closeout Procedures."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 112400
BUILDING MAINTENANCE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Building maintenance equipment system and supplementary items necessary for installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer/fabricator’s technical literature for each product and system indicated.

1. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Locate anchorages to suit maintenance equipment to be used on the Project. Considerations shall be made addressing such items as reach, rigging, spacing, roof edge condition, and other similar items.
2. Design anchor components to provide adequate attachment to the building structure that is suited to suspended maintenance industry practices and to ensure compatibility with equipment to be provided in this Project.
    a. Indicate structural loads imposed on the building structure and exterior cladding systems.
3. Indicate electrical connections for equipment, including power requirements, characteristics and locations.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer/Fabricator's Project Acceptance Document: Certification by the manufacturer/fabricator that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

D. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1. Posted Record Drawings: Provide plastic laminate encased record roof plan at each point of access to roof indicating equipment locations and details.
    a. Include installed equipment configuration and locations, record specifications documenting changes to original design criteria and other specification requirements.
    b. Include wiring diagrams indicating electrical connections for equipment.
2. Inspection Forms and Certificate of Compliance:
    a. Equipment Manual and Inspection Log Book including completed Initial Inspection - Certification for Use and Inspection Sign-Off Forms, including:
        1) System equipment and components have been manufactured and installed in compliance with applicable codes, regulations and requirements of authorities having jurisdiction.
        2) System equipment and components have been inspected and tested successfully.
        3) System is operational and ready for use by Owner.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

1. Insurance Coverage: Manufacturer/fabricator shall carry specific liability insurance (products and completed operations) in the amount of $10,000,000.00 to protect against product / system failure of building maintenance equipment.
2. Litigation Disclosure: If any, submit written explanation of nature of litigation resulting in failure of equipment.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 10 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 10 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

C. Regulatory Requirements:

1. Codes and Standards: The Work, including equipment, performance, use, inspection, testing and maintenance shall comply with the most restrictive applicable codes, regulations and requirements of authorities having jurisdiction, including but not limited to the most current version of the following:

a. Occupational Safety and Health Act (OSHA).
b. American Society of Mechanical Engineers ASME/ANSI A120.1 Safety Requirements for Powered Platforms for Building Maintenance.
c. International Window Cleaners Association IWCA/ANSI I-14.1 - Window Cleaning Safety.

D. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, the following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.

f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. HighRise Systems, Inc.
2. Guardian Fall Protection.
3. Pro-Bel Enterprises, Ltd.
4. Rooftop Anchors, Inc.
5. Spider, a Division of SafeWorks, LLC.
6. Sky Rider Equipment Co., Inc.
7. Tractel Group, Swingstage Division.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated. Contractor shall obtain required design data and identify movements accommodated on submittal drawings.

1. Wind Loads: As indicated in Drawings or Wind Analysis Report.
2. Other Loads: As indicated on Drawings.

C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads:

1. Movements: As indicated in Drawings or Wind Analysis Report.

D. Delegated Engineering Quality Standards: Determine allowable working stresses of materials according to authorities having jurisdiction, applicable local building codes, or information indicated, or, if standard not indicated, use latest editions of following:

1. Structural Steel: AISC S342L with Supplement No. 1, “Load and Resistance Factor Design Specification for Structural Steel Buildings”.
2. Aluminum: AA ADM-1.
3. Window Cleaning Safety: ANSI/IWCA I-14.1 and OSHA 1910, Subpart D.
4. Personal Fall Arrest: Appendix C to OSHA 1910 Subpart F.
5. Powered Platforms:

   a. OSHA 1910.66, Subpart F.
   b. ASME A120.1.

6. Electrical: NEC with UL listed devices.

E. Thermal Movements: Engineer products and systems to accommodate thermal movements of supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses, damaging loads on fasteners, failure of operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

F. Dimensional Tolerances: Engineer products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

1. Equipment Layout and Coordination: Locate anchorages to suit suspension equipment that will be used on building with respect to items such as reach, rigging, spacing, roof edge condition, and similar items. Coordinate components with architectural and structural concept expressed in Contract Documents. Changes to Contract Documents, including reinforcing and concrete materials and installation, necessitated by equipment shall be considered as a substitution.
2. Interface with Roof Coverings: Exposed portion of roof mounted components shall not be less than height indicated so that it is suitable for enclosure by sheet metal flashing.

2.4 MATERIALS

A. Metal Material Qualities: Metal used for components with not less than strength and durability properties required to fulfill performance requirements for components.

B. Steel Plates, Shapes, and Bars: ASTM A 36 / A 36M.

C. Steel Pipe: ASTM A 53 / A 53M.

D. Aluminum:

1. Extruded Bars, Tubes and Shapes: ASTM B 221 / B 221M.
2. Plate and Sheet: ASTM B 209 / B 209M.
3. Drawn Seamless Tubes: ASTM B 483 / B 483M.
4. Castings: ASTM B 26 / B 26M.

E. Stainless Steel:

1. Tubing: ASTM A 554, Grade MT 304.
2. Pipe: ASTM A 312 / A 312M, Grade TP 316.
3. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 316.
4. Bars and Shapes: ASTM A 276, Type 316.
5. Castings: ASTM A 743 / A 743M, Grade CF 8 or CF 20.
6. Wire Rope: ASTM A 492, Type 316 wire, stranded according to engineered design.

F. Welding Rods and Bare Electrodes: Selected according to AWS specifications for metal alloy to be welded.

2.5 FASTENERS

A. Fastener Materials: Stainless steel fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items, including to other types of construction indicated.

B. Stainless Steel Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.6 COMPONENTS

A. Component Quality: Size, thicknesses, and materials with not less than strength and durability properties required by delegated engineering.

B. Davit Base:

1. Roof Mounted: Assembly composed of welded steel plates and steel pipe suitable for bolted or welded anchoring to building roof structure; capable of receiving and supporting davit arms and socket housing; galvanized after fabrication.
2. Wall Mounted: Assembly composed of welded steel plates and steel pipe suitable for bolted or welded anchoring to building wall or parapet; capable of receiving and supporting davit arms and socket housing; galvanized after fabrication.

C. Davits:

1. Arms: High profile type tall enough to allow platform to be swung over building parapet into working position and back.

   a. Assembly composed of treated structural aluminum sections of sufficient length and size equipped with carrying handles to allow movement to be accomplished by not more than 2 people.
   b. Capable of rotating 360 degrees.
   c. Permanently attached bearing assembly consisting of cast aluminum housing and bearing system transmitting bending and vertical load to socket housing.
   d. Separate mechanical safety cable mounted in davit between wire rope rigging point and davit bearing block.
   e. Rotation locks.

2. Socket Housing: Assembly composed of welded steel plates and hard rubber wheel suitable for moving from davit base to davit base; capable of receiving and supporting davit arms; galvanized after fabrication.
3. Data Plate: Permanent, non-corrosive plate clearly stating maximum service capacity and allowable number of users; prominently displayed at access points to system.

D. Safety Tiebacks:

1. Wall Mounted: Minimum 3/4 in (19 mm) diameter stainless steel bar, formed in minimum 1- 1/2 in (38 mm) U-shape eye opening, welded to stainless steel base plate suitable for bolted mounting indicated.
2. Roof Mounted: Minimum 3/4 in (19 mm) diameter stainless steel bar, formed in minimum 1-1/2 in (38 mm) U-shape eye opening, welded to stainless steel cap attached to galvanized steel pipe; field welded to either steel building structure, or steel embed plates in concrete.

E. Rigging Sleeves: Galvanized steel pipe, not less than 6 in (150 mm) inside diameter, with flanges for mounting indicated, with removable galvanized steel cap assembly tethered to pipe assembly.

F. Intermittent Stabilization Anchors:

1. Surface Mounted Buttons: Exposed stainless steel rod with button-like head with threaded anchoring device of size and configuration for attachment to building facade.
2. Recessed Mounted Detent Pins: Recessed stainless steel insert with outside end machined to receive detent pin and inside end with threaded anchoring device of size and configuration for attachment to building facade.

G. "Hands Free" Horizontal Cable Lifeline System: Assembly composed of following components:

1. Cable: Stainless steel wire with permanently swedged ends.
2. End Terminal: Stainless steel swedged termination at one end and stainless steel tensioner with shock absorber at other end.
3. Mounting Devices: Stainless steel shape as required by mounting conditions.
4. Cable Runner: Stainless steel device with automatic runner bypass for continuous "hands free" operation that can be inserted or removed anywhere on cable.
5. Data Plate: Permanent, non-corrosive plate clearly stating maximum service capacity and allowable number of users; prominently displayed at access points to system.
6. Harness: Manufacturer's standard "Hands-free" full body harness and lanyard complete with shock absorber.

H. Monorails: Horizontal with manual or electric traversing trolleys composed of following components:

1. Track: Extruded aluminum profile with end caps, splice devices, expansion connections and other items as required for complete assembly; clear anodized finish.
2. Mounting Brackets:

   a. Exposed: Standard or custom configuration.
   b. Concealed: Steel or aluminum of configuration required.

3. Manual Traversing Trolleys: Stainless steel or cadmium plated steel suspension assembly with 4 traversing and 2 guide molded polymer wheels on hardened steel bearings; including locking device, safety and primary suspension points, and other items as required for complete assembly.
4. Powered Traversing Trolleys: Stainless steel encased geared motor, connected to manual traversing trolleys, with pinion engaging chain within track; including primary brake, overspeed brake, limits, controls, overload switch, thermal overload protection device, and other items as required for complete assembly; voltage as indicated on Electrical Drawings.
5. Data Plate: Permanent, non-corrosive plate clearly stating maximum service capacity and allowable number of users; prominently displayed at access points to system.

I. Vertical Personnel Access:

1. Cage: Rigid assembly fabricated of structural aluminum and galvanized steel consisting of following characteristics and components:

   a. Nominal 30 in (750 mm) by 36 in (900 mm) plan dimensions.
   b. Gross load capacity of not less than 1,250 pounds (565 kg).
   c. Non-slip aluminum deck.
   d. Tubular aluminum guardrails 42 in (1050 mm) high, with access gate.
   e. Sheet aluminum toeboards around base of deck.
   f. Self-contained, load-sensitive traction hoist below deck for controlled ascent and descent; including primary brake, overspeed brake, limits, controls, overload switch, thermal overload protection device, and other items as required for complete assembly; travel speed not less than 25 ft (7.5 m) per minute; voltage as indicated on Electrical Drawings.

2. Cable: Stainless steel wire with permanently swedged ends.
3. Minimum Controls:

   a. Up and down operation buttons.
   b. Variable speed control.
   c. Emergency stop button.
   d. Power on indicator light.
   e. Meter that records operating time.
   f. Hand crank for emergency descent in case of power failure.

4. Remote Control: Same controls as on cage in lockable cabinets located as directed by Owner or Architect; separate controls for each cage.

J. Accessories: Stainless steel brackets, shims, clips, and other items as required for complete assemblies. Pins and fittings subject to removal secured by wire rope lanyards.

2.7 FABRICATION

A. Shop Assembly: Preassemble components in shop to greatest extent possible.

B. Cutting and Forming:

1. Cut, drill, and punch metals cleanly and accurately.
2. Remove burrs and ease edges to a radius of approximately 1/32 in (0.8 mm), unless otherwise indicated.
3. Remove sharp or rough areas on exposed surfaces.
4. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.
5. Form exposed Work true to line and level with accurate angles and surfaces and straight edges.

C. Welding:

1. Weld continuously using materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Assembling:

1. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

2. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated.
3. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water; provide weep holes where water may accumulate.

2.8 FINISHES

A. Clear Anodized Aluminum Finish: AA-M12C22A41 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class I Architectural, clear film thicker than 0.7 mil) complying with AAMA 611, Class 1.

B. Galvanized Steel: After fabrication of component, apply zinc-coating by hot-dip process complying with following requirements:

1. ASTM A 153 / A 153M for galvanizing iron and steel hardware.
2. ASTM A 123 / A 123M for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 in (0.7 mm) thick and heavier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform building maintenance equipment Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator’s installation written instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer/fabricator’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF BUILDING MAINTENANCE EQUIPMENT

A. Install components in locations shown on shop drawings in plumb and true vertical and horizontal alignment.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

C. Contractor Testing and Inspections: Conduct full live load and operational testing under maximum design live loading conditions on equipment and components in accordance with current OSHA requirements and other applicable codes and regulations to ensure compliance and full operational functionality of the overall system.

1. Operate systems over full range (horizontally and vertically) of building surfaces where equipment is intended to provide access and maintenance.

3.6 DEMONSTRATION

A. Operational and Maintenance Training: Provide on-site instruction by factory-trained and certified technicians for Owner's personnel. Provide bound copies of training materials for each attendee.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 115213
PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Perform work required to complete the projection screens indicated by the contract documents and furnish supplementary items necessary for their proper installation.

1.2 ACTION SUBMITTALS

A. Samples: Submit for approval samples of screen materials showing construction and finish specified.

B. Shop Drawings: Submit manufacturer's literature and mark sufficiently to indicate compliance with these specifications. Show locations, methods of supporting, methods of anchoring and finishes of each projection screen.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section “Substitution Procedures”.

1. Da-Lite Screen Company
2. Draper Inc.
3. Stewart Filmscreen Corporation

2.2 MATERIALS

A. Projection Screens (Electrically Operated): Da-Lite Screen Co., Inc., "Professional Electrol" Automatic Electric Projection Screen, size as indicated on the drawings.

1. Screen shall be electrically operated with a 120 volt AC (60 Hz) 2.4 amp, three (3) wire quick reversal motor, especially designed for the purpose. Motor shall be ball bearing type, and oiled for life, with automatic thermal overload cut-out and integral interlocking gears.
2. Screen operating system shall have pre-set but accessible limit switches to automatically stop screen fabric in the "up" and "down" positions. Stop action shall be positive, to prevent coasting.
3. System shall include a rigid metal roller at least 3 in (75 mm) diameter (to be used for screens 12' or less in width), or 5-3/4 in (142 mm) diameter (to be used on screens 14' to 18' in width), or 7 in (175 mm) diameter (to be used on screens where either height or width exceeds 20'). Roller shall be mounted on two cast aluminum brackets equipped with self-aligning bearings.
4. Screen surface shall be flame retardant and mildew resistant, black masking borders, and with the following viewing surface:

   a. Matte white.

5. Case shall be of wood with double top for extra rigidity and sound deadening.
6. Case shall be finished with a primer coat, ready to accept final finish by others.
7. Heavy metal adjustable brackets shall be furnished for mounting screen as follows:

a. Ceiling.
b. Walls.
c. Structure above ceiling.

8. System shall be complete with three (3) position control switch in box with cover plate.
9. The complete screen unit shall be "Listed by Underwriters' Laboratories, Inc.", and shall bear the re-examination markers of the Underwriters' Laboratories, Inc.

B. Projection Screens (Manually Operated): Da-Lite Screen Co., Inc. Model "Video B", manually operated spring roller type Screen, size(s) as indicated.

1. Case: Heavy gage octagon shape steel case with flat back design with baked enamel finish, fitted with heavy duty chrome case end caps concealing roller ends with integral bearing surface or steel inner caps to support roller.
2. Mounting Brackets: Plated steel brackets attached to end caps for wall mounting by means of slotted screw holes and ceiling mounted by means of plated steel hanger rings. Furnish heavy angle adjustable steel extension wall brackets.
3. Screen Fabric:

a. Viewing surface shall be as follows with masking borders on flame retardant and mildew resistant fabric.

1) Matte white.
2) Glass-beaded.

b. Bottom of fabric shall be mounted into a metal strip in a tubular steel slat finished in baked enamel. Ends of slat shall be protected by plastic caps.
c. Fabric shall be mounted into a metal strip in a metal "camlok" roller system without tape, glue, staples or cords, so that fabric may be easily replaced yet, cannot be pulled from roller.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be as indicated on the Drawings.

B. Installation shall be in accordance with the manufacturer's latest published requirements, specifications and details.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 117000
MEDICAL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work of this Section includes related wall support, mechanical and electrical connections for medical equipment provided by Owner.

B. Medical equipment information at the end of this Section is for reference only.

1.2 ACTION SUBMITTALS

A. Product Data: Furnished by Owner.

B. Shop Drawings: Contractor shall furnish shop drawings of equipment installation when necessary to ensure coordination of the Work.

PART 2 - PRODUCTS

2.1 OWNER FURNISHED / OWNER INSTALLED EQUIPMENT

A. Products: Identified as "OFOI". Product is provided by Owner and installed by Owner.

B. Contractor Responsibilities: Limited to interface, surface preparations and utilities indicated on the Drawings or specified in the Specifications.

2.2 OWNER FURNISHED / CONTRACTOR INSTALLED EQUIPMENT

A. Products: Identified as "OFCI". Product is provided by Owner and installed by the Contractor.

B. Contractor Responsibilities: Provide labor, transportation, materials, tools, appliances and utilities necessary for the following:

1. Transportation of product from Owner's facility to the job site.
2. Receiving and storage of product.
3. Installation of product, complete and in operating condition, including adjusting and calibration of product as necessary for proper operation.
4. Testing of product.
5. Paying of fees, licenses, and taxes in conjunction with installation of the product.
6. Roughing-in and final utility connections for product remain the work of specification sections governing the specific utility.

2.3 CONTRACTOR FURNISHED / CONTRACTOR INSTALLED EQUIPMENT

A. Products: Identified as "CFCI". Product is provided by Contractor and installed by Contractor.

B. Contractor Responsibilities: Furnish equipment and installation as indicated in other specification sections.

2.4 OWNER FURNISHED / VENDOR INSTALLED EQUIPMENT

A. Products: Identified as "OFVI". Product provided by Owner, and installed by Owner's vendor.

B. Contractor Responsibilities: Limited to interface, surface preparations and utilities indicated on the Drawings or specified in the Specifications.

2.5 FUTURE EQUIPMENT

A. Products: Identified as "Future". Product provided by Owner and installed by others in the future.

B. Contractor Responsibilities: Limited to interface, surface preparations and utilities indicated on the Drawings or specified in the Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. For Contractor installed medical equipment, examine substrate surfaces to receive medical equipment and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 PREPARATION

A. Coordinate work of this Section with related work of other Sections to obtain proper installation of items. Become acquainted with the work of other Sections whose work abut, adjoin or are in any way affected by or related to work under this Section.

B. Carefully examine the drawings and directions and be responsible for proper installation of materials and product without substantial changes.

C. Indication of pipe connection sizes on the plans shall in no way relieve Contractor of the responsibility of checking and verifying their sizes and locations from the actual product to be installed and any available roughing-in diagrams.

3.3 SCOPE OF WORK

A. Back-up Support: Provide wall reinforcing, backing and bracing for wall mounted equipment.

B. Concrete: Provide work indicated or required including, but not limited to, the following:

1. Housekeeping pads.
2. Trenches.
3. Anchor bolts.
4. Vibration isolation devices.
5. Core drilling.
6. Sleeves.

C. Heating, Ventilating, and Air Conditioning (HVAC): Provide work indicated or required including, but not limited to, exhaust ducts from connection point of equipment to building exhaust system.

D. Plumbing: Provide work indicated or required, including, but not limited to, the following:

1. Devices such as vacuum breakers, pressure reducing valves, shut-off valves, trim, traps, filters, etc.
2. Water, waste, gas, air, and steam connections to equipment.

E. Electrical: Provide work indicated or required including, but not limited to, the following:

1. Wiring and devices.
2. Power and lighting service.
3. Connections to equipment.

3.4 SCHEDULE OF MEDICAL EQUIPMENT

A. Refer to document that immediately follows this Section.

B. Refer to separately bound document.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 122413
ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Roller window shades and supplementary items necessary to complete their installation.

1. Manually operated roller shades.
2. Motor-operated roller shades.

B. Related Requirements:

1. Motorized Units: Division 26 Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized shade operation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 in (250 mm) square. Mark inside face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 in (400 mm) wide by 36 in (900 mm) long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 in (250 mm) long.

D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Field Quality Control Reports - Motor Operated Shades: Written report of testing and inspection required by "Field Quality Control".

C. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1. Methods for maintaining roller window shades and finishes.

2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.
4. Motorized shade operator.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications: Fabricator of products.

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.6 MOCKUPS

A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

   a. Architect.
   b. Contractor, including superintendent.
   c. Installer, including project manager and supervisor.
   d. If requested, Manufacturer/fabricator's qualified technical representative.
   e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document Requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer/fabricator's specifications.

3. Record discussions, including decisions and agreements reached and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to the following:

a. Fabric failure includes deterioration, sag, warp, fade or will not remain fit for use.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for the following periods from date of Substantial Completion

a. Manual operating components: 10 years.
b. Shade Cloth: 10 years.
c. Motors and electronic components: 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Draper Inc.
2. Hunter Douglas Contract.
3. Lutron Electronics Co., Inc.
4. Mariak Contract
5. MechoShade Systems, Inc.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIRMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Window Covering Safety Standard: Provide roller window shades that comply with WCMA A100.1.

C. Fire Performance: Tested in accordance with and meeting the flame propagation performance criteria of Test 1 or Test 2, as appropriate, of NFPA 701; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

D. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

1. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

a. Drapery Operators: UL CCN FDDR, including UL 325.

E. Accessibility Standards: Comply with applicable provisions in the ADA Standards for Accessible Design ICC A117.1.

2.4 SHADE SCHEDULE

A. RS-01 - Shade Type 1: Manual operating, chain drive, light filtering shadebands.

B. RS-02 - Shade Type 2: Manual operating, chain drive, light blocking shadebands.

C. RS-03 - Shade Type 3: Manual operating, chain drive double roller, inside light filtering shadebands, outside light blocking shadebands, operating independently of each other. Include related mounting systems and accessories.

D. RS-04 - Shade Type 4: Motorized, light filtering shadebands. Include related motor control systems.

E. RS-05 - Shade Type 5: Motorized. Light blocking shadebands. Include related motor control systems.

F. RS-06 - Shade Type 6: Motorized, double roller, inside light filtering shadebands, outside light blocking shadebands, operating independently of each other. Include related motor control systems.

2.5 MANUALLY OPERATED SHADES

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard, Stainless steel.

a. Loop Length: Full length of roller shade, unless otherwise indicated.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Clip, Chain tensioner and mounting as selected by Architect.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criteria are more stringent.

B. Rollers - Single: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: As indicated on Drawings.
2. Direction of Shadeband Roll: Regular, from back of roller, unless otherwise indicated.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Rollers - Double: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Double-Roller Mounting Configuration: Offset, outside roller over and inside roller under, unless otherwise indicated.
2. Inside Roller:

a. Drive-End Location: As indicated on Drawings.
b. Direction of Shadeband Roll: Regular, from back of roller.

3. Outside Roller:

a. Drive-End Location: As indicated on Drawings.
b. Direction of Shadeband Roll: Reverse, from front of roller

4. Shadeband-to-Roller Attachment: Manufacturer's standard method.

2.6 MOTOR-OPERATED

A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable

operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
    a. Electrical Characteristics: Single phase, 110 V, 60 Hz, unless recommended otherwise by manufacturer.
3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
    a. Individual Switch Control Station: Momentary-contact, three -position, rocker-style, wall-switch-operated control station with open, close, and center off functions.
    b. Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for single-switch group control.
    c. Individual/Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for individual and group control.
    d. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
    e. Color: As selected by Architect from manufacturer's full range.
4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
5. Operating Features:
    a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
    b. Capable of interface with audiovisual control system.
    c. Capable of accepting input from building automation control system.
    d. Override switch, if applicable.

B. Rollers - Single: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: As indicated on Drawings.
2. Direction of Shadeband Roll: Regular, from back of roller, unless otherwise indicated.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Rollers - Double: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Double-Roller Mounting Configuration: Offset, outside roller over and inside roller under, unless otherwise indicated.
2. Inside Roller:
    a. Drive-End Location: As indicated on Drawings.
    b. Direction of Shadeband Roll: Regular, from back of roller.
3. Outside Roller:
    a. Drive-End Location: As indicated on Drawings.

b. Direction of Shadeband Roll: Reverse, from front of roller

4. Shadeband-to-Roller Attachment: Manufacturer's standard method.

2.7 SHADEBANDS AND ACCESSORIES

A. Shadebands - Single Roller:

1. Shadeband Material: Refer to Shade Schedule for type. Color as scheduled or as indicated in Design Selections.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material, unless otherwise indicated.
b. Color and Finish: As selected by Architect from manufacturer's full range.

B. Inside Shadebands - Double Roller:

1. Shadeband Material: Refer to Shade Schedule for type. Color as scheduled or indicated in Design Selections.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material
b. Color and Finish: As selected by Architect from manufacturer's full range

C. Outside Shadebands - Double Roller:

1. Shadeband Material: Refer to Shade Schedule for type. Color as scheduled or indicated in Design Selections.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Exposed with endcaps and integral light seal with bottom (sill) channels.
b. Color and Finish: As selected by Architect from manufacturer's full range.

D. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped.
b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 4 in (100 mm).

2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 4 in (100 mm).

3. Endcap Covers: To cover exposed endcaps.
4. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.

a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 6 in (150 mm)
b. Provide pocket with lip at lower edge to support acoustical ceiling panel.

5. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.

a. Closure-Panel Width: As indicated on Drawings.

6. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
7. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
8. Installation Accessories Color and Finish: As selected from manufacturer's full range.

E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.

F. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

2.8 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Shade Band Material: PVC-coated polyester blend.

C. Shade Band Material: Manufacturer's standard PVC-free shade band material.

2.9 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 in (6 mm) per side or 1/2 in (12 mm) total, plus or minus 1/8 in (3 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 in (6 mm), plus or minus 1/8 in (3 mm).
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material. Obtain approved locations from Architect prior to fabrication.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting

performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.3 ROLLER-SHADE INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 in (50 mm) to interior face of glass. Allow clearances for window operation hardware.

C. Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.4 FIELD QUALITY CONTROL - MOTOR OPERATED SHADES

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.5 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.6 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

3.8 FINISH SCHEDULE

A. Color and Pattern Selection: As selected from manufacturer full range of patterns and colors.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 123553
LABORATORY CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes metal laboratory casework with stainless steel and phenolic countertops along with supplementary items necessary to complete their installation.

B. Related Section:

1. Division 06 Section "Interior Architectural Woodwork" for shop-fabricated plastic laminate-clad and wood veneer-clad casework, millwork, and cabinetry.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturers technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Indicate locations of hardware and keying of locks.
2. Indicate locations and types of service fittings.
3. Indicate locations of blocking and reinforcements required for installing laboratory casework.
4. Include details of utility spaces showing supports for conduits and piping.
5. Include details of exposed conduits, if required, for service fittings.
6. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
7. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Samples for Verification: Unless otherwise directed, approved full-size Samples may become part of the completed Work, if in an undisturbed condition at time of Substantial Completion. Notify Architect of their exact locations. If not incorporated into the Work, retain acceptable full-size Samples at Project site and remove when directed by Architect.

1. One full-size, finished base cabinet complete with hardware, doors, and drawers.
2. One full-size, finished wall cabinet complete with hardware, doors, and adjustable shelves.
3. One Sample each of hinged and sliding doors.
4. 6-inch- (150-mm-) square Samples for each type of countertop material.
5. One of each service fitting specified, complete with accessories and specified finish.
6. One of each type of sink and accessory item specified.
7. One of each type of hardware item specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports for Casework: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework with requirements of specified product standard.

B. Product Test Reports for Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface materials with requirements specified for chemical and physical resistance.

C. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

1.4 CLOSEOUT SUBMITTALS

A. Touchup Kit for Metal: Furnish complete touchup kit for each type and color of metal laboratory casework provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.

B. Touchup Kit for Wood: Furnish complete touchup kit for each type and color of wood laboratory casework provided. Include scratch fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

C. Casework Product Standard: Comply with SEFA 8, "Laboratory Furniture - Casework, Shelving and Tables - Recommended Practices."

D. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction.

E. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by FM Approvals.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.

5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet work are complete and dry, and temporary HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Obtain countertops, sinks, accessories, and service fittings from casework manufacturer.

2.2 METAL CABINET MATERIALS

A. Metal: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.

2.3 AUXILIARY CABINET MATERIALS

A. Acid Storage-Cabinet Lining: 1/4-inch- (6-mm-) thick, glass-fiber cement board complying with ASTM C 1186, polyethylene or polypropylene, or polyethylene, polypropylene, epoxy, or phenolic-composite lining material.

B. Glass for Glazed Doors: Clear tempered glass complying with ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 mm thick.

C. Frameless Glass Doors: Clear tempered glass complying with ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 mm thick; with exposed edges seamed before tempering.

2.4 COUNTERTOP MATERIALS

A. Phenolic Composite: Solid, high-pressure decorative laminate, complying with NEMA LD 3, Grade CGS.

1. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.
2. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.
3. Manufacturers:

a. Arbonite; a division of ITW Canada.
b. Epoxyn Products.
c. Formica Corporation.
d. Nevamar Company, LLC.
e. NuLab Furniture Corporation.
f. Panolam Industries International Incorporated; Pionite Decorative Surfaces.
g. Trespa North America.

4. Chemical Resistance: Composite countertop material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:

a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, formaldehyde (37 percent), furfural, hydrochloric acid (37 percent), hydrofluoric acid (48 percent), nitric acid (30 percent), phosphoric acid (85 percent), sodium hydroxide (20 percent), sulfuric acid (33 percent), toluene, and zinc chloride.

5. Color: As selected by Architect from manufacturer's full range.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 316L.

2.5 SINK MATERIALS

A. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.

1. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed.

If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

2. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.
3. Manufacturers:
   a. Durcon Company (The).
   b. Epoxyn Products.
   c. Laboratory Tops, Inc.
   d. Prime Industries, Inc.
4. Physical Properties:
   a. Flexural Strength: Not less than 10,000 psi (70 MPa).
   b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
   c. Hardness (Rockwell M): Not less than 100.
   d. Water Absorption (24 Hours): Not more than 0.02 percent.
   e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
5. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
   a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
   b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
6. Color: As selected by Architect from manufacturer's full range.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

2.6 METAL CABINETS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:
   1. Keur Industries, Inc.
   2. Kewaunee Scientific Corporation; Laboratory Products Group.
   3. Lab Design/United Hospital Supply Corp.
   4. Mott Manufacturing Ltd.
   5. Thermo Fisher Scientific (formerly Fisher Hamilton).

D. Fabrication: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Except where otherwise specified, integrally frame and weld cabinet bodies to form dirt and vermin-resistant enclosures. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch (1.5 to 2.4 mm).

E. Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.

F. Glazed Doors: Hollow-metal stiles and rails of similar construction as flush doors, with glass held in resilient channels or gasket material.

G. Hinged Doors: Mortise for hinges and reinforce with angles welded inside inner pans at hinge edge.

H. Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Provide drawers with rubber bumpers, polymer roller slides, and positive stops to prevent metal-to-metal contact or accidental removal.

I. Adjustable Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.

J. Toe Space: Fully enclosed, 4 inches (100 mm) high by 3 inches (75 mm) deep, with no open gaps or pockets.

K. Tables: Welded tubing legs, not less than 2 inches (50 mm) square with channel stretchers as needed to comply with product standard. Weld or bolt stretchers to legs and cross-stretchers, and bolt legs to table aprons. Provide leveling device welded to bottom of each leg.

1. Leg Shoes: Satin-finished stainless steel, open-bottom, slip-on type.

L. Utilities: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate utility services and their support-strut assemblies.

1. Provide base cabinets with removable backs for access to utility space.

M. Utility-Space Framing: Laboratory casework manufacturer's standard steel framing units consisting of 2 steel slotted channels complying with MFMA-4, not less than 1-5/8 inches (41 mm) square by 0.105-inch (2.66-mm) nominal thickness, and connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch (32-by-6-mm) steel flat bars. Framing units may be made by welding specified channel material into rectangular frames instead of using U-shaped brackets.

N. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets and with hemmed or flanged edges unless otherwise indicated.

1. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
2. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.
3. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed. Fabricate from back-to-back panels or of hollow construction to eliminate exposed hemmed or flanged edges.

2.7 METAL CABINET FINISH

A. General: Prepare, treat, and finish welded assemblies after assembling. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.

B. Preparation: After assembly, clean surfaces of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply laboratory casework manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
2. Colors for Metal Laboratory Casework Finish: As selected by Architect from manufacturer's full range.

2.8 HARDWARE

A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges: Stainless-steel, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors 48 inches (1200 mm) high or less and 3 for doors more than 48 inches (1200 mm) high.

C. Hinged Door and Drawer Pulls: Solid aluminum, stainless steel, or chrome-plated brass back-mounted pulls. Provide 2 pulls for drawers more than 24 inches (600 mm) wide.

1. Design: Wire pulls.
2. Overall Size: 1-3/8 by 5-1/2 inches (35 by 140 mm).

D. Sliding Door Pulls: Stainless-steel or chrome-plated recessed flush pulls.

1. Design and Size: Oval, 1 by 3 inches (25 by 76 mm), 3/8 inch (10 mm) deep.

E. Pulls: Recessed aluminum pulls. Provide 2 pulls for drawers more than 24 inches (600 mm) wide.

F. Pulls for Metal Cabinets: Full-width, recessed channel pulls; integrally formed from front pan of doors and drawer fronts.

G. Door Catches: Nylon-roller spring catches. Provide 2 catches on doors more than 48 inches (1200 mm) high.

H. Drawer Slides: Side mounted, epoxy-coated steel, self-closing; designed to prevent rebound when drawers are closed; complying with BHMA A156.9, Type B05091.

1. Provide Grade 1HD-100; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
2. Provide Grade 1HD-200; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.
3. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Full-extension, ball-bearing type.

I. Label Holders: Stainless steel, aluminum, or chrome plated; sized to receive standard label cards approximately 1 by 2 inches (25 by 50 mm), attached with screws or rivets. Provide on all drawers.

J. Locks for Metal Cabinets: Cam or half-mortise type, brass with chrome-plated finish; complying with BHMA A156.11, Type E07281, E07111, or E07021.

1. Provide a minimum of two keys per lock and two master keys.
2. Provide on all drawers and doors.

3. Keying: Key locks alike within each room; key each room separately.
4. Master Key System: Key all locks to be operable by master key.

K. Sliding-Door Hardware Sets: Laboratory casework manufacturer's standard, to suit type and size of sliding-door units.

L. Adjustable Wall Shelf Supports: Surface-type steel standards and steel shelf brackets, with epoxy powder-coated finish, complying with BHMA A156.9, Types B04102 and B04112.

2.9 COUNTERTOPS AND SINKS

A. Countertops, General: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch (25 mm), with continuous drip groove on underside 1/2 inch (13 mm) from edge.

B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Architect.

1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2 (DN 40), unless otherwise indicated.
2. Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches (50 mm) less than sink depth. Provide in same material as strainer.

C. Epoxy Sinks:

1. Sink Fabrication: Molded in 1 piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch (13-mm) minimum thickness.

a. Provide with polypropylene strainers and tailpieces.
b. Provide sinks for drop-in installation with 1/4-inch- (6-mm-) thick lip around perimeter of sink.
c. Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.
d. Provide manufacturer's recommended adjustable support system for table- and cabinet-type installations.

D. Phenolic-Composite Countertops:

1. Countertop Fabrication: Fabricate with cutouts for sinks, holes for service fittings and accessories, and with butt joints assembled with epoxy adhesive and concealed metal splines.

a. Countertop Configuration: Flat, 3/4 inch (19 mm) thick, with beveled edge and corners, and with drip groove and integral coved backsplash.
b. Countertop Configuration: As indicated.

2. Table-Top Fabrication:

a. Table-Top Configuration: Flat, 1 inch (25 mm) thick, with beveled edge and corners, and with drip groove at perimeter.

3. Shelf Configuration: Flat, 3/4 inch (19 mm) thick, with beveled edge and corners.

E. Stainless-Steel Countertops: Made from stainless-steel sheet, not less than 0.062-inch (1.59-mm) nominal thickness, with No. 4 satin finish.

1. Extend top down 1 inch (25 mm) at edges with a 1/2-inch (13-mm) return flange under frame. Apply heavy coating of heat-resistant, sound-deadening mastic to undersurface.

2. Form backsplash coved to and integral with top surface.
3. Provide raised (marine) edge around perimeter of countertops at sinks, where indicated; pitch two ways to sink to provide drainage without channeling or grooving.
4. Punch holes for service fittings at factory.
5. Reinforce underside of countertop with channels or use thicker metal sheet where necessary to insure rigidity without deflection.
6. Weld shop-made joints.
7. Where field-made joints are required, provide hairline butt-joints mechanically bolted through continuous channels welded to underside at edges of joined ends. Keep field jointing to a minimum.
8. Where stainless-steel sinks or cup sinks occur in stainless-steel countertops, factory weld into one integral unit.
9. After fabricating and welding, grind surfaces smooth and polish as needed to produce uniform, directionally textured finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.

F. Stainless-Steel Shelves: Made from stainless-steel sheet, not less than 0.050-inch (1.27-mm) nominal thickness, with No. 4 satin finish. Weld shop-made joints. Fold down front edge 3/4 inch (19 mm); fold up back edge 3 inches (75 mm). Provide integral stiffening brackets, formed by folding up ends 3/4 inch (19 mm) and welding to upturned back edge. After fabricating, grind welds smooth and polish as needed to produce uniform, directionally textured finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.

G. Stainless-Steel Sinks: Made from stainless-steel sheet, not less than 0.050-inch (1.27-mm) nominal thickness. Fabricate with corners rounded and coved to at least 5/8-inch (16-mm) radius. Slope sink bottoms to outlet. Provide double-wall construction for sink partitions with top edge rounded to at least 1/2-inch (13-mm) diameter. Provide continuous butt-welded joints. After fabricating and welding, grind surfaces smooth and polish as needed to produce uniform finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.

1. Punch holes for fittings at factory.
2. Provide with stainless-steel strainers and tailpieces.
3. Provide with integral rims except where located in stainless-steel countertops.
4. Apply 1/8-inch- (3-mm-) thick coating of heat-resistant, sound-deadening mastic to undersink surfaces.

H. Cup Sinks: Material and size as indicated.

1. Provide epoxy cup sinks with polypropylene strainers and integral tailpieces.
2. Provide stainless-steel cup sinks with stainless-steel strainers and integral tailpieces.

I. Troughs: Epoxy or stainless steel, as indicated. Pitch to drains not less than 1/8 inch/foot (10 mm/m). Except where troughs empty into sinks, provide NPS 1-1/2 (DN 40) outlets with strainers and tailpieces.

1. Epoxy Troughs: Molded in 1 piece with smooth surfaces and coved corners; 3/4-inch (19-mm) minimum thickness. Provide polypropylene strainers and tailpieces.
2. Stainless-Steel Troughs: Made from stainless-steel sheet, not less than 0.062-inch (1.59-mm) nominal thickness. Fabricate with corners rounded and coved to at least 5/8-inch (16-mm) radius. Provide continuous butt-welded joints. After fabricating and welding, grind surfaces smooth and polish as needed to produce uniform finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove

embedded foreign matter and leave surfaces clean. Provide stainless-steel strainers and tailpieces.

2.10 WATER AND LABORATORY GAS SERVICE FITTINGS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Broen A/S.
2. Chicago Faucet Company (The); a Geberit Company.
3. WaterSaver Faucet Co.

D. Service Fittings: Provide units that comply with SEFA 7, "Laboratory and Hospital Fixtures - Recommended Practices." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

1. Provide units that comply with "Vandal-Resistant Faucets and Fixtures" recommendations in SEFA 7.

E. Materials: Fabricated from cast or forged red brass unless otherwise indicated.

1. Reagent-Grade Water Service Fittings: Polypropylene, PVC, or PVDF for parts in contact with water.

F. Finish: Chromium plated unless otherwise indicated.

1. Provide chemical-resistant powder coating in laboratory casework manufacturer's standard metallic brown, aluminum, white, or other color as approved by Architect.
2. Where indicated, provide acid- and solvent-resistant powder coating complying with requirements in SEFA 7 for corrosion-resistant finishes.

G. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig (550 kPa).

1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
2. Aerators: Provide aerators on water fittings that do not have serrated outlets.
3. Self-Closing Valves: Provide self-closing valves where indicated.

H. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, and held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig (280 kPa), with serrated outlets.

I. Ball Valves: Chrome-plated ball and PTFE seals. Handle requires no more than 5 lbf (22 N) to operate. Provide units designed for working pressure up to 75 psig (520 kPa), with serrated outlets.

1. Where ball valves are indicated for fuel-gas use, provide locking safety handles that must be pushed in or pulled up before being turned on unless otherwise indicated].

J. Steam Valves: Stainless-steel seat and PTFE seat disc. Provide units designed for steam working pressure up to 20 psig (140 kPa), with serrated outlets.

K. Needle Valves: Provide units with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal, with removable serrated outlets.

1. Provide units designed for working pressure as indicated on drawings.

L. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."

M. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.

N. Handles: Provide three- or four-arm, forged-brass handles for valves unless otherwise indicated.

1. Provide lever-type handles for ground-key cocks. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
2. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
3. Provide knurled, molded plastic handles for needle valves.

O. Service-Outlet Identification: Provide color-coded plastic discs with embossed identification, secured to each service-fitting handle to be tamper resistant. Comply with SEFA 7 for colors and embossed identification.

2.11 ELECTRICAL SERVICE FITTINGS

A. Service Fittings, General: Provide units complete with metal housings, receptacles, terminals, switches, pilot lights, device plates, accessories, and gaskets required for mounting on laboratory casework.

B. Receptacles: Comply with NEMA WD 1, NEMA WD 6, and UL 498. Duplex type, Configuration 5 20R.

1. Receptacle Grade: Hospital grade unless otherwise indicated.
2. Color of Receptacles: As selected by Architect unless otherwise indicated or required by NFPA 70.
3. GFCI Receptacles: Straight blade, feed-through or non-feed-through type. Comply with UL 943, Class A, Hospital grade, and include indicator light that is lighted when device is tripped.
4. TVSS (Transient Voltage Surge Suppressor) Receptacles: Comply with UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.

a. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and a minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
b. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
c. Receptacle Type: Hospital grade, with isolated-ground terminal.
d. Identification: Distinctive marking on face of device to denote TVSS-type unit.
e. Color of TVSS Receptacles: Blue.

C. Switches: Comply with NEMA WD 1 and UL 20. Provide single-pole, double-pole, or 3-way switches as required; rated 120 to 277-V ac; and in amperage capacities to suit units served.

1. Color of Switches: As selected by Architect unless otherwise indicated or required by NFPA 70.

2. Provide pilot light adjacent to switch or neon-lighted handle, illuminated when switch is "ON," where noted as "PL" next to switch identification.
3. Provide key-operated switch where noted as "KEY" next to switch identification.
4. Provide thermal-overload switches, single or double pole, as required, with maximum overcurrent trip setting to suit particular motor controlled.

D. Pedestal-Type Fittings: Cast-aluminum housings with sloped single face or two faces, as indicated, with neoprene gasket under base and with concealed mounting holes in base for attaching to laboratory casework. Provide holes tapped for conduits.

E. Line-Type Fittings: Provide with cast-metal boxes with threaded holes for mounting on rigid steel conduit. Provide cover plates same size as boxes.

F. Recessed-Type Fittings: Provide with galvanized-steel boxes.

G. Finishes for Service-Fitting Components: Provide housings or boxes for pedestal- and line-type fittings with manufacturer's standard baked-on, chemical-resistant enamel in color as selected by Architect from manufacturer's full range.

H. Cover Plates: Provide satin finish, Type 304, stainless-steel cover plates with formed, beveled edges.

I. Cover-Plate Identification: Use 1/4-inch- (6-mm-) high letters unless otherwise indicated. For stainless steel or chrome-plated metal, stamp or etch plate and fill in letters with black enamel.

1. Provide at the following locations:

a. Receptacles other than standard 125-V duplex, grounding type.
b. Switches and thermal-overload switches.
c. Pilot lights when located remotely from associated equipment or switch, where function is not obvious.
d. Receptacles, switches, and other locations indicated.

2. Provide the following information:

a. Voltage and phase for receptacles other than standard 125-V duplex, grounding type.
b. Indicate equipment being controlled by switches and thermal-overload switches.
c. Indicate equipment being controlled for pilot lights when located remotely from associated equipment or switch, where function is not obvious.
d. Number of breaker in panelboard that controls device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricators written installation instructions.
2. Accepted submittals.

3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturers instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF CABINETS

A. Comply with installation requirements in SEFA 2.3. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet (1.5 mm in 3 m).
2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet (3 mm in 3 m).
3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet (3 mm in 3 m).
4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.5 mm).

B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.

C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches (600 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches (600 mm) o.c. and at sides of cabinets with not less than 2 fasteners per side.

D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches (600 mm) o.c.

E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

F. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.5 INSTALLATION OF COUNTERTOPS

A. Comply with installation requirements in SEFA 2.3. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints.

1. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.

C. Fastening:

1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches (1200 mm) o.c.
3. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch (3 mm) and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

D. Provide required holes and cutouts for service fittings.

E. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.

F. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

G. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.6 INSTALLATION OF SINKS

A. Comply with installation requirements in SEFA 2.3.

B. Underside Installation of Epoxy Sinks: Use laboratory casework manufacturer's recommended adjustable support system for table- and cabinet-type installations. Set top edge of sink unit in sink and countertop manufacturers' recommended chemical-resistant sealing compound or adhesive and firmly secure to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement. Remove excess sealant or adhesive while still wet and finish joint for neat appearance.

C. Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

D. Drop-in Installation of Epoxy Cup Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

3.7 INSTALLATION OF LABORATORY ACCESSORIES

A. Install accessories according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions.

B. Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.

C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

D. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.

3.8 INSTALLATION OF SERVICE FITTINGS

A. Comply with requirements in other Sections for installing water and laboratory gas service fittings and electrical devices.

B. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.10 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil (0.15-mm) plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches (1200 mm) o.c.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 123571
STAINLESS STEEL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes stainless-steel healthcare casework and supplementary items necessary for installation for the following:

1. Stainless steel casework.
2. Stainless-steel countertops, shelves, and sinks.
3. Specialty Cabinets:

a. Narcotics Cabinets.
b. Specimen Pass-Through Cabinets.
c. Warming Cabinets.
d. Desk Units.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Indicate locations of blocking and reinforcements required for installing casework.
2. Indicate hardware locations.
3. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.
4. Include coordinated dimensions for equipment specified in other Sections.

C. Keying Schedule: Include schematic keying diagram, and index each key set to unique designations that are coordinated with the Contract Documents.

D. Samples for Verification: For each type of exposed hardware indicated, in full-size units.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

B. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Jamestown Metal Products.
2. MASS Medical Storage.
3. STERIS Corporation.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 CASEWORK MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, stretcher-leveled standard of flatness.

B. Nominal Stainless-Steel Thicknesses for Stainless-Steel Healthcare Casework:

1. Sides, Ends, Fixed Backs, Bottoms, Cabinet Tops, Soffits, and Items Not Otherwise Indicated: 0.050 in (1.25). Bottoms may be 0.038 in (0.95 mm) if reinforced.
2. Back Panels, Doors, Drawer Fronts and Bodies, and Shelves: 0.038 in (0.95 mm) except 0.050 in (1.25 mm) for unreinforced shelves more than 36 in (900 mm) long.
3. Intermediate Horizontal Rails, Center Posts, Tubular Legs, and Top Gussets: 0.062 in (1.59 mm).
4. Drawer Runners and Hinge Reinforcements: 0.078 in (1.9 mm).
5. Leveling and Corner Gussets: 0.109 in (2.7 mm).

C. Glass for Glazed Doors: Clear tempered glass complying with ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 mm thick.

D. Clear Tempered Glass Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; 6.0 mm thick; with exposed edges seamed before tempering.

E. Pegboard: Provide one or both of the following types as indicated on drawings:

1. Type 1: 1/4 in (6 mm) perforated hardboard, complying with ANSI A135.4, Class 1 tempered; with painted finish sealing faces, edges, and perimeter of holes.
2. Type 2: Perforated stainless-steel sheet, 0.050 in (1.25 mm) nominal thickness.

F. Insulation for Warming Cabinets: Semirigid, glass-fiber board insulation complying with ASTM C 612, Type IA or Type IB.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 CABINET FABRICATION

A. General: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Integrally frame and weld to form a dirt- and vermin-resistant enclosure. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 in (1.5 to 2.4 mm).

B. Metal Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.

C. Glazed Doors: Hollow-metal stiles and rails of similar construction as flush doors, with glass held in resilient channels or gasket material.

D. Hinged Doors: Mortise doors for hinges and reinforce with angles welded inside inner pans or hollow-metal stiles at hinge edge.

E. Metal Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal.

F. Metal Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels. Provide clips, brackets, pilasters, or other means to support shelves from cabinet ends and to allow height of shelves to be adjusted in increments of not more than 2 in (50 mm).

G. Sloping Tops: Unless tops are concealed by other construction, provide sloping tops on cabinets with tops 60 in (1500 mm) or more above the finished floor. Slope tops 25 degrees or more and construct of same material and with same finish as cabinets.

H. Toe Space: Unless casework is built-in, provide metal toe space, fully enclosed, 4 in (100 mm) high by 3 in (75 mm) deep, with no open gaps or pockets.

I. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets and with hemmed or flanged edges.

J. Trim Flanges: Formed metal trim fabricated from same material and with same finish as cabinets. Provide at perimeter of recessed cabinets.

2.5 STAINLESS-STEEL COUNTERTOPS, SHELVES, AND SINKS

A. Countertops: Fabricate from 0.062 in (1.59 mm) thick, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects. Provide front and end overhang of 1 in (25 mm) over the base cabinets.

1. Joints: Fabricate countertops without field-made joints.
2. Weld shop-made joints.
3. Sound-deaden the undersurface with heavy-build mastic coating.
4. Extend the top down to provide a 1 in (25 mm) thick edge with a 1/2 in (12 mm) return flange.
5. Form the backsplash coved to and integral with top surface, with a 1/2 in (12 mm) thick top edge and 1/2 in (12 mm) return flange.
6. Provide raised (marine) edge around perimeter of tops containing sinks; pitch tops containing sinks two ways to provide drainage without channeling or grooving.
7. Where stainless-steel sinks occur in stainless-steel tops, factory weld into one integral unit.

B. Wall-Mounted Shelves: Fabricate from stainless-steel sheet, not less than 0.050 in (1.25 mm) nominal thickness. Weld shop-made joints. Fold down or up, as indicated on drawings, the front edge a minimum of 3/4 in (19 mm); fold up the back edge a minimum of 3 in (75 mm). Provide integral stiffening brackets, formed by folding up ends a minimum of 3/4 in (19 mm) and by welding to upturned back edge.

C. Stainless-Steel Sinks: Fabricate from stainless-steel sheet, not less than 0.050 in (1.25 mm) nominal thickness. Fabricate with corners rounded and coved to at least 5/8 in (15 mm) radius. Slope the sink bottoms to outlet without channeling or grooving. Provide continuous butt-welded joints.

1. Provide sizes indicated or manufacturer's closest standard size of equal or greater volume, as approved by Architect.
2. Provide double-wall construction for sink partitions with top edge rounded to at least 1/2 in (12 mm) diameter.
3. Factory punch holes for fittings.
4. Provide sinks with stainless-steel strainers and tailpieces.
5. Provide sinks with integral rims except where located in stainless-steel countertops.
6. Apply 1/8 in (3 mm) thick coating of heat-resistant, sound-deadening mastic to undersink surfaces.

2.6 SPECIALTY CABINETS

A. Narcotics Cabinets: Construct of stainless steel as individual, freestanding units with finished sides and top and double-walled bottom. Provide with double-pan flush outer door and 0.062 in (1.59 mm) nominal thickness, single-pan inner door, both with locks; each is individually keyed and not master keyed.

B. Specimen Pass-Through Cabinets: Construct of stainless steel as through-wall units with double-walled construction and smooth interior. Provide with double-pan flush doors with interlocking hardware that prevents each door from being opened when the other door is open. Provide with removable, stainless-steel spill tray and trim flanges for both faces.

C. Warming Cabinets: Recessed units covered on back, top, and sides with 1 in (25 mm) thick insulation. Insulate double-pan door and equip with heat-resistant gasket. Provide with thermostatically controlled heating system to maintain temperature within 10 deg. F (-9.4 deg. C) of temperature setting that can be varied from 97 to 160 deg. F (36 to 71 deg. C).

1. Equip units with fan-forced electric heating system.

D. Desk Units: Recessed units with sloped stainless-steel writing surface, magnetic stainless-steel back panel, and built-in fluorescent light fixture.

1. Provide drawers under the writing surface as indicated.

2. Provide keyboard drawer under the writing surface and provide drawers and space for CPU under keyboard drawer as indicated. Provide rack or articulated arm, as indicated on drawings, for monitor over the writing surface.

2.7 STAINLESS-STEEL FINISH

A. Grind and polish surfaces to produce uniform, directional-satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

2.8 CABINET HARDWARE

A. General: Provide healthcare casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges: Stainless-steel, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and hospital tips. Provide two hinges for doors 48 in (1200 mm) high or less, and provide three for doors more than 48 in (1200 mm) high.

C. Continuous Hinges: Stainless-steel continuous hinges complying with BHMA A156.9, Grade 1. Provide for specialty cabinets.

D. Hinged Door and Drawer Pulls: Back-mounted pulls of stainless steel.

1. Design: As selected from manufacturer's full range.
2. Overall Size: As selected from manufacturer's full range.

E. Sliding Door Pulls: Recessed flush pulls of stainless steel or chrome plated. Provide two pulls for drawers more than 24 in (600 mm) wide.

1. Design and Size: As selected from manufacturer's full range.

F. Door Catches: Nylon-roller spring catches. Provide two catches on doors more than 48 in (1200 mm) high.

G. Drawer Slides: Side-mounted, epoxy-coated-steel, self-closing, ball-bearing drawer slides; designed to prevent rebound when drawers are closed; complying with BHMA A156.9, Type B05091.

1. Provide Grade 1 for drawers not more than 6 in (150 mm) high and 24 in (600 mm) wide.
2. Provide Grade 1HD-100 for drawers more than 6 in (150 mm) high or 24 in (600 mm) wide.
3. Provide Grade 1 for computer keyboard drawers.
4. Provide full-extension type where Grade 1 is indicated.
5. Provide full-extension type where Grade 1HD-100 or Grade 1HD-200 is indicated.

H. Locks: Cam or half-mortise type; brass with chrome-plated finish; complying with BHMA A156.11, Type E07281, E07111, or E07021.

1. Provide minimum of two keys per lock and two master keys.
2. Provide locks where indicated.
3. Keying: Key locks as directed.
4. Master Key System: Key all locks to be operable by master key.

I. Sliding-Door Hardware Sets: Healthcare casework manufacturer's standard, to suit type and size of sliding-door unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF CABINETS

A. Install cabinets level, plumb, and true; shim as required, using concealed shims. Where healthcare casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 in in 10 feet (1.5 mm in 3 m).
2. Variation of Bottoms of Upper Cabinets from Level: 1/8 in in 10 feet (3 mm in 3 m).
3. Variation of Faces of Cabinets from a True Plane: 1/8 in in 10 feet (3 mm in 3 m).
4. Variation of Adjacent Cabinet Surfaces from a True Plane (Lippage): 1/32 in (0.8 mm).
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 in (1.5 mm).

B. Recessed Cabinets: Set cabinets in openings and fasten to partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 in (600 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

C. Base Cabinets: Fasten cabinets to partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 16 in (400 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through the back, near the top, at not less than 16 in (400 mm) o.c.

E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

F. Adjust healthcare casework and hardware so doors and drawers align and operate smoothly without warp or bind and so contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.5 INSTALLATION OF COUNTERTOPS

A. Install metal countertops level, plumb, and true; shim as required, using concealed shims.

B. Field Jointing: Where possible, make field jointing in the same manner as shop jointing; use fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

C. Secure tops to cabinets with Z- or L-type fasteners or equivalent; use two or more fasteners at each front, end, and back.

D. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.

E. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

F. Wall-Mounted Shelves: Fasten to masonry, partition framing, blocking, or reinforcements in partitions. Fasten each shelf through upturned back edge at not less than 24 in (600 mm) o.c.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.7 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6 mil (0.15 mm) plastic or other suitable water-resistant covering over the countertop surfaces. Tape to underside of countertop at a minimum of 48 in (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 123661
SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The following simulated stone countertops along with supplementary items necessary for installation:

1. Solid surfacing countertops.
2. Quartz agglomerate countertops.
3. Cultured marble countertops.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Show materials, finishes, edge profiles, methods of joining, locations, and details of joints.
2. Show locations and sizes of cutouts and holes for plumbing fixtures, accessories and other items installed in fabrications.
3. Show direction of directional pattern, if any.

C. Samples for Verification Purposes:

1. Panel Material: 6 in (150 mm) square, showing color and pattern selected. Trim piece samples to be 6 in (150 mm) long.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For simulated stone fabrications to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of sources for products.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.

2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.

C. Fire-Test-Response Characteristics: Provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Solid Surfacing:

a. Avonite Surfaces
b. E. I. du Pont de Nemours and Company
c. Formica Corporation
d. LG Chemical, Ltd.
e. Meganite Inc.
f. Samsung Chemical USA, Inc.
g. Swan Corporation (The)
h. Transolid, Inc.
i. Wilsonart International

2. Quartz Agglomerate:

a. Cambria
b. Cosentino USA
c. E. I. du Pont de Nemours and Company
d. LG Chemical, Ltd.
e. Meganite Inc.

f. Samsung Chemical USA, Inc.
g. Technistone USA, Inc.
h. Transolid, Inc.

3. Cultured Marble:

a. Bathroom World Manufacturing Company
b. Cameo Marble
c. Cherry Marble Group.
d. Comar Products, Inc.
e. Craig Baker Marble Co., Inc.
f. Cultured Marble Products
g. Custom Marble Products
h. Custom Marble Products, Inc.
i. Imperial Marble Corp.
j. Marbleon, Inc.
k. MarCraft, Inc.
l. Mincey Marble Manufacturing, Inc.
m. Princess Marble
n. Roma Marble, Inc.
o. Rynone Manufacturing Corp.
p. Tiffany Marble

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 SOLID SURFACE MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Colors and Patterns: As scheduled or indicated in Design Selections.

B. Panel Thickness: Minimum 1/2 in (12 mm) or as indicated on drawings.

2.4 QUARTZ AGGLOMERATE MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of polymers, resins, and pigment and complying with ISFA 3-01.

1. Colors and Patterns: As scheduled or indicated in Design Selections.

B. Panel Thickness: Minimum 1/2 in (12 mm) or as indicated on drawings.

2.5 CULTURED MARBLE MATERIALS

A. Cultured Marble: Gel-coated solid fabrication of filled plastic resin complying with CSA B45.5/IAPMO Z124.

1. Colors and Patterns: As scheduled or indicated in Design Selections.

B. Panel Thickness: Minimum 1/2 in (12 mm) or as indicated on drawings.

2.6 ACCESSORIES

A. Subtop Materials:

1. Medium-Density Fiberboard: ANSI A208.2, minimum Grade 130-MR50, made with binder containing no added urea formaldehyde.
2. Softwood Plywood: DOC PS 1, Exposure 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness. Panel Grade B-C.

B. Lavatory Bowls: Provide one or both types below, as indicated on drawings:

1. Integral Lavatory Bowl (Rectangular): Made of solid surfacing material; nominal 15 in (375 mm) front-to-back by 20 in (500 mm) side-to-side inside plan dimension by 5 in (125 mm) deep; drain 4 in (100 mm) from rear side, provide unit with overflow; seam-mount installation.

   a. Manufacturer and Product: Gemstone Sinks; Model 1812-VO.

2. Integral Lavatory Bowl (Oval): Made of solid surfacing material; 13 in (330 mm) front-to-back by 16-1/2 in (416 mm) side-to-side inside plan dimension by 5 in (127 mm) deep; drain 4-1/8 in (104 mm) from rear side, provide unit with no overflow; seam-mount installation.

   a. Manufacturer and Product: Gemstones Sinks; Model 1613-HV with No Overflow.

3. Integral Lavatory Bowl (Oval): Made of solid surfacing material; 13 in (330 mm) front-to-back by 16-1/2 in (419 mm) side-to-side inside plan dimension by 5-1/2 in (140 mm) deep; drain 4-1/8 in (104 mm) from rear side, provide unit with side overflow; seam-mount installation.

   a. Manufacturer and Product: Dupont; Corian 810P with Side Overflow.

4. Under-slung or Self-Rimming Lavatory Bowls: Where indicated, provide as specified in Division 22 Plumbing Sections.

C. Backsplash: Preformed 4 in (100 mm) high coved backsplash, to match countertop.

D. Front Edge Trim: Preformed 1-1/2 in (38 mm), to match countertops.

2.7 FABRICATION

A. Comply with simulated stone manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate items without joints unless otherwise indicated.
2. Fabricate countertops with shop-applied backsplashes and edges, unless otherwise indicated

B. Cutouts and Holes: Accurately cut holes and drill panels in shop for penetrations, fittings and other accessories indicated on Drawings. Obtain field measurements prior to fabrication and maintain minimum clearance at walls.

1. Make cutouts using template or pattern. Form cutouts to smooth, even curves.
2. Drill fabrications for fittings and similar items.

2.8 INSTALLATION MATERIALS

A. Adhesives: Product recommended by simulated stone manufacturer.

B. Accessories: Provide joint seam adhesives and other items required for a complete installation as recommended in writing by simulated stone manufacturer.

C. Sealant: Mildew resistant silicone sealant as specified in Division 07 Section Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 in per 48 in (1.5 mm per 1200 mm).

B. Variation from Level: Do not exceed 1/8 in per 96 in (3 mm per 2400 mm), 1/4 in (6 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/4 of nominal joint width.

D. Variation in Plane at Joints (Lipping): Do not exceed 1/64 in (0.4 mm) difference between planes of adjacent units.

E. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64 in (0.4 mm) difference between edges of adjacent units, where edge line continues across joint.

3.5 INSTALLATION

A. Secure countertops to subtops with adhesive according to material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

B. Bond joints with adhesive and draw tight as fabrications are set. Mask surfaces of fabrications adjacent to joints to prevent adhesive smears.

1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

C. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

D. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

E. Complete cutouts not finished in shop. Mask areas of fabrications adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in subtops by saturating with varnish.

F. Apply sealant and compress to form bond with simulated stone material and adjacent surfaces and tool sealant surface to clean, straight lines.

1. Comply with Division 07 Section Joint Sealants.

3.6 CLEANING

A. Promptly clean simulated stone as work progresses to minimize final cleaning. Do not leave adhesive or sealant to dry on simulated stone faces.

B. Final clean and protect installed countertops in accordance with manufacturer's instructions.

3.7 FINISH SCHEDULE

A. Color: As selected by Architect from manufacturer's standard colors.

B. Color:

C. SSF01:

1. Type:

a. Solid Surfacing
b. Quartz Agglomerate
c. Cultured Marble

2. Manufacturer:
3. Color:

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 124843
ENTRANCE FLOOR MATS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes roll-up (removable) rail mats entryway flooring systems for recessed applications along with supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, sections, details of components, joint locations, details of patterns or designs and attachments to other work. Distinguish between shop and field-assembled work.

1. Coordinate Shop Drawings showing oversized recess if deferred installation of frames with concrete work is necessary.

C. Samples for Verification: 12 inch (300 mm) square assembled sections of floor mats, frame members, and tread rails with selected tread surface showing each type of metal finish and color of exposed floor mats, tread rails, frames, and accessories required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For cleaning and maintaining floor mats to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Defer frame installations until building enclosure is completed and related interior finish work is in progress.

C. Coordinate size and location of oversized recesses in concrete work to receive floor mats and frames.

D. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. American Floor Products Company, Inc.
2. ARDEN Architectural Specialties, Inc.
3. Balco, Inc.
4. Construction Specialties, Inc. (C/S Group)
5. J.L. Industries, Inc.
6. Kadee Industries, Inc.
7. Pawling Corporation; Architectural Products Division
8. Reese Enterprises, Inc.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 ENTRANCE FLOOR MATS, GENERAL

A. Structural Performance: Provide roll-up rail mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:

1. Uniform floor load of 300 lbf/sq. ft. (14.36 kN/sq. m).
2. Wheel load of 350 lb (159 kg) per wheel.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

2.4 ROLL-UP HINGED MATS

A. General: Provide colors, patterns, and profiles of materials, including metals and metal finishes indicated or specified. If not indicated, provide colors, patterns, and profiles selected by Architect from manufacturer's standards.

B. Roll-up, Vinyl-Rail Hinged Mats: Vinyl-acrylic tread rails 1-1/2 inches (38 mm) wide by 3/8 inch (9.5 mm) thick, with slotted or perforated hinges.

1. Tread Inserts:

a. Textured-surface, resilient vinyl.
b. 1/4-inch- (6.4-mm-) high, 28-oz./sq. yd. (950-g/sq. m) weight, level-cut, nylon-pile, fusion-bonded carpet. As selected by Architect from full range of industry colors.

2. Rail Color: As selected by Architect from full range of industry colors.
3. Hinges: Aluminum.
4. Mat Size: As indicated.
5. Product Standard: C/S Group; Pedimat series.

C. Roll-up, Aluminum-Rail Hinged Mats: Extruded-aluminum tread rails 1-1/2 inches (38 mm) wide by 3/8 inch (9.5 mm) thick, sitting on continuous vinyl cushions.

1. Tread Inserts:

a. Plain serrated aluminum treads.
b. Textured-surface, resilient vinyl.
c. 1/4-inch- (6.4-mm-) high, 28-oz./sq. yd. (950-g/sq. m) weight, level-cut, nylon-pile, fusion-bonded carpet. As selected by Architect from full range of industry colors.

2. Rail Color: As selected by Architect from full range of industry colors and color densities.
3. Hinges: Aluminum.
4. Mat Size: As indicated.
5. Product Standard: C/S Group; PediTred series.

2.5 CARPET TYPE MATS

A. Carpet-Type Walk-Off Mats: Refer to Division 09 Section "Carpeting" for carpet tiles used as walk-off mats.

2.6 FRAMES

A. Recessed Frames: Manufacturer's standard extrusion.

1. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.

a. Color: Mill finish.

2.7 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.8 FABRICATION

A. Floor Mats: Shop-fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION, ENTRANCE FLOOR MATS

A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.

1. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.5 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION

SECTION 129300

SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general and supplementary general conditions shall apply to all work under this section.

B. Separation of these specifications into sections is for convenience only and is not intended to establish limits of work.

C. Consult the index to be certain that the set of documents and specifications is complete. Report omissions or discrepancies to the Landscape Architect before bidding.

1.2 SUMMARY

A. The work covered by this section of the specifications consists of furnishing all labor, material, equipment and supplies in performing all operations in connection with site furnishings and all site work in strict accordance with this section of specifications and applicable drawings. Site furnishings may include, but are not limited to:

1. Seating.
2. Bicycle racks.
3. Trash receptacles.
4. Planters.

B. Any minor items of labor or materials not specifically noted on the drawings or specifications; but obviously necessary for the proper completion of the work, are to be considered as incidental to and are to be included in the contract.

C. Submit Contractor's construction schedule of anticipated work time to facilitate timely visits for review of work.

D. Work under this section of specifications shall include coordination of all work with all other sections of these specifications.

E. For complex, pre-fabricated systems, upon completion of the project submit the following to the owners:

1. One digital copy and 3 prints of "as-built" drawing showing all buried utilities, vaults, connections, and equipment for the item. Drawings shall be to scale with dimensions indicating exact location of underground lines from permanent structures.
2. One digital copy and one print of owner's operation manuals indicating information for installation and maintenance of the site furnishings.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Licensed firms regularly engaged in manufacture of specified products of types, materials, and sizes required, whose products have been in satisfactory use in similar service.

B. Installer Qualifications: Licensed firm regularly engaged in successful installation of products similar to that required for project.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for specified materials and products.

B. Shop Drawings: Submit shop drawings for specified materials, size, locations, and connections.

C. Maintenance Data: Submit maintenance data and parts lists for specified materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCT

2.1 Provide site furnishing in style, size and color as specified on drawings or approved equal. Submit color sample for approval prior to installation.

PART 3 - EXECUTION

3.1 Install according to manufacturer’s recommendations and as per applicable construction detail.

3.2 GUARANTEE

A. All work shall be guaranteed for compliance with the contract requirements, including replacement for a period of (1) one year from date of substantial completion. If unsatisfactory conditions or damage develops in the period stipulated by the guarantee and is due to neglect, faulty materials or workmanship, the contractor shall immediately place it in satisfactory condition. All guarantees shall be in writing and worded as approved by the landscape architect.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 132817
BALLPARK NETTING AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ballpark netting, engineered support system, and supplementary items required for installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.

a. Aesthetic Effects: Design expressed in selection, shape, and arrangement of particular products; dimensions; alignments; profiles; sightlines.
b. Performance Characteristics: Design expressed in performance criteria subject to verification by one or more methods including but not limited to manufacturing source testing, pre-construction testing, field testing, or in-service performance.

2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

5. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: Submit 12 in (300 mm) square samples of each product specified.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For inclusion in operation and maintenance manual required by Division 1, submit manufacturer’s instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods, which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

1. General Responsibilities: Manufacturing/fabricating ballpark netting and support structure and providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.

d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with ballpark netting and support structure.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate installation of anchorages for ballpark netting and support structures. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. C&H Baseball Inc.
2. West Coast Netting, Inc.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

1. Structural Steel: AISC S335, "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary."
2. Cold-Formed Structural Steel: AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."

C. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction.

D. Structural Performance: Provide metal fabrications capable of withstanding structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of metal fabrications.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.3 BALLPARK NETTING

A. General: System includes netting and cable support system for stadium backstop.

B. Basis of Design: West Coast Netting, Inc. Spectra Netting #18ST-1 3/4"; 540 lb per cord.

1. Backstop Netting: SPECTRA #18, Allied Signal SPECTRA polyethylene fiber, approximate tensile strength per bar is 350 lbs, 3200 denier per ply for a total count of 9,600. Treated to provide additional UV and weather protection.
2. Backstop Cable Support System: Cables shall be galvanized IWRC 7 x 19 class or 6 x 19 class. Cable fittings shall be galvanized and sized to match the load carrying capacity of the cable or design load where the fitting is used including but not limited to turnbuckles, shackles, coupling links, wall brackets, net hold down clips, etc.

2.4 METALS

A. Metal Surfaces, General: Provide metal free from pitting, seam marks, roller marks, and other imperfections where exposed to view on finished units.

1. Provide galvanized metal at unconditioned and exterior exposures, unless indicated otherwise.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.5 PAINT

A. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.6 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

2.7 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.8 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

E. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

F. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

G. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

H. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

I. Remove sharp or rough areas on exposed traffic surfaces.

J. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.9 ACCESSORIES

A. Provide manufacturer’s standard accessories for complete installation including carabineers, thimbles, turnbuckles, stainless steel aircraft cabling, cable clamps, hog rings, pliers, s-hooks, quick links, and snap clips.

2.10 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.

B. Galvanizing: Hot-dip galvanize items fabricated for exterior exposure to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing iron and steel products.
2. ASTM A 153, for galvanizing steel and iron hardware.
3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive ballpark netting and support structure and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standard: In addition to standards listed elsewhere, perform ballpark netting work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator’s written installation instructions.
2. Approved submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work

3.4 INSTALLATION OF BALLPARK NETTING AND SUPPORT STRUCTURES

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form tight joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Backstop Net and Cable Support System:

1. Install cables according to the practices recommended by the Wire Rope Technical Board.
2. Install net so net pattern is horizontal and vertical.
3. Install net to cables by lacing the perimeter of the net to the cable (every other mesh) using treated twine with a tensile strength equal to or greater that the net.
4. Cables shall be free of all kinks and bends. Care shall be taken not to injure or damage cables during installation.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to touch up shop-painted surfaces in accordance with paint manufacturer’s recommendations.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 134900
RADIATION PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Radiation protection systems and supplementary items necessary for installation.

1. Lead sheet, strip, and plate.
2. Lead bricks.
3. Borated polyethylene sheets.
4. Lead-lined gypsum board.
5. Lead glass.
6. Lead-lined hollow-metal doors.
7. Lead-lined hollow-metal frames.
8. Lead-lined solid core or split core flush wood doors.
9. Lead-lined film transfer cabinets.
10. Neutron shielding doors and frames.
11. Informational signs.

B. Related Requirements:

1. Division 03 Section Cast-in-Place Concrete for concrete floor topping over lead shielding in concrete slabs.
2. Division 08 Section Hollow Metal Doors and Frames for additional door and frame requirements.
3. Division 08 Section Solid Core Flush Wood Doors for additional door requirements.
4. Division 08 Section Glazing for additional glazing requirements.

1.2 DEFINITIONS

A. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.

1. Lead equivalence specified for materials used in diagnostic x-ray rooms is as measured at 100 kV unless otherwise indicated.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Doors and Frames: Include construction details, material descriptions, core descriptions, fire-resistance ratings and finishes.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work

1. Show layout of radiation-protected areas, indicating lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.
2. Show ducts, pipes, conduit, and other objects that penetrate radiation protection; include details of penetrations.
3. Show details of joints between radiation protection materials.

4. Show details of securing lead bricks to structure.
5. Include door details, including elevations, frame dimensions and profile, and clearances and undercuts.
6. Neutron-Shielding Doors: Show details of neutron-shielding doors and frames, including anchorage to and coordination with other work. Show locations of electrical conduit and boxes for connecting door operators, door operator switches, and door interlock switches.

    a. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: For assemblies with radiation protection materials, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Miscellaneous metal members that support lead bricks.
2. Items penetrating radiation protection materials, including the following:

    a. Electrical services.
    b. Air outlets and inlets.
    c. Sprinklers.
    d. Access panels.
    e. Other penetrations.

D. Product Schedule: For observation windows, doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

B. Warranty:

1. Provide manufacturer written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance for Data Neutron-Shielding Doors: For neutron-shielding doors to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar in scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Electrical Components, Devices, and Accessories for Neutron-Shielding Doors: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.
g. Sequence and schedule of radiation protection work in relation to other work.
h. Supplementary lead shielding at duct, pipe, and conduit penetrations of radiation protection.
i. Methods of attaching other construction and equipment to lead-lined finishes.
j. Notification procedures for work that requires modifying radiation protection.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Lead-Lined Gypsum Panels: Store inside under cover, and keep dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

B. Lead-Lined, Hollow-Metal Doors and Frames: Comply with requirements in Division 08 Section Hollow Metal Doors and Frames for delivery, storage, and handling.

C. Lead-Lined Wood Doors: Comply with requirements in Division 08 Section Solid Core Flush Wood Doors for delivery, storage, and handling.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install radiation protection until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

A. Warranty for Lead-Lined Wood Doors: Comply with requirements in Division 08 Section Solid Core Flush Wood Doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. A & L Shielding Inc.
2. NELCO, Inc.
3. Radiation Protection Products, Inc.
4. Ray-Bar Engineering Corp.

D. Lead Glass Manufacturers Only:

1. Amerope Enterprises, Inc.
2. McGrory Glass, Inc.
3. Schott North America, Inc.

2.2 MATERIALS, GENERAL

A. Source Limitations: Obtain each type of radiation protection product from single source from single manufacturer unless otherwise indicated.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.

C. Materials, thicknesses, and configurations of radiation protection products indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor upon request.

D. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in lead-lined assemblies of not less than lead thickness indicated for doors, door frames, window frames, penetration shielding, joint strips, film transfer cabinets, and other assemblies in which they are installed.

E. Lead Glazing: Unless otherwise indicated, provide lead equivalence of not less than that indicated for assembly in which glazing is installed.

F. Fire-Rated and Smoke-Control Door and Frame Assemblies: Comply with Division 08 Section Hollow Metal Doors and Frames and Division 08 Section Solid Core Flush Wood Doors.

2.4 LEAD SHEET, STRIP, AND PLATE

A. Lead Sheet, Strip, and Plate: ASTM B749, Alloy UNS No. L51121 (chemical-copper lead).

2.5 LEAD BRICKS

A. Lead Bricks: Cast- or extruded-lead bricks with interlocking tongue and grooves or wedge-shape edges, made from pig lead complying with ASTM B29 with 0.5 percent antimony added.

2.6 BORATED POLYETHYLENE SHEETS FOR NEUTRON-SHIELDING DOORS

A. Borated Polyethylene Sheets: High-density polyethylene containing not less than 5 percent boron.

1. Color: As selected by Architect from manufacturer's standard selection.

2.7 LEAD-LINED GYPSUM BOARD

A. Lead-Lined Gypsum Board: 5/8-inch- (15.9-mm-) thick gypsum board complying with Division 09 Section Gypsum Board Assemblies, of width and length required for support spacing and to prevent cracking during handling, and with a single sheet of lead laminated to the back of the board.

1. Lead Sheet Lining: Full width and length of board unless Owner's radiation health physicist report indicates coverage to extend from floor to 84 inches (2134 mm) above floor

a. Provide 2-inch- (50-mm-) wide lead strips for backing joints.
b. Provide 3-inch- (75 mm) wide lead strips for wrapping metal stud flanges.

2. Furnish finishing materials, accessories, and trim for lead-lined gypsum board complying with Division 09 Section Gypsum Board.

a. Provide 5/16 in (8 mm) lead disks for covering screw heads.
b. Provide lead-headed nails for fastening gypsum board, accessories, and trim to wood members.

2.8 LEAD GLASS

A. Lead Glass: Lead-barium, polished glass containing not less than 60 percent heavy metal oxides, including not less than 48 percent lead oxide by weight.

1. Safety Glazing: Where safety glazing is indicated or required, provide glazing that complies with 16 CFR 1201, Category II.
2. Laminated Safety Glass: ASTM C1172 lead glass with thickness as needed to provide lead equivalence indicated laminated with polyvinyl butyral interlayer to clear float glass on both sides of lead glass.

a. Polyvinyl butyral interlayer or cured resin of manufacturer's standard thickness having a proven record with no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lights and installation.

2.9 LEAD-LINED HOLLOW-METAL DOORS

A. Lead-Lined Hollow-Metal Doors: Steel doors complying with NAAMM-HMMA 861, except as indicated.

1. Provide single continuous sheet of lead of thickness not less than that required for partition in which door is installed extending from top to bottom and edge to edge, supported by hat-channel stiffeners. Do not weld stiffeners through lead lining.
2. Line-inverted channels at top and bottom of doors with lead sheet of same thickness used in door and close with filler channels to provide flush top and bottom edges.
3. Shield cutouts for locksets with lead sheet of same thickness used in door. Overlap lining of cutouts with lining of door by 1 inch (25 mm).
4. Prepare doors to receive openings; factory cut and trim openings through doors. Furnish removable stops for glazed openings.
5. Furnish lead-lined astragals for pairs of doors.
6. Factory fit doors to suit frame-opening sizes indicated with 1/16-inch (1.6-mm) clearance at heads and jambs and minimum clearance at bottom.
7. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

B. Metal Frames for Glazed Lights: Lead-lined frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

C. Lead Door Louvers: Louvers with 30 percent free area made from formed-lead sheet or lead extrusions of not less than lead thickness required for door in which louver is installed. Fabricate louvers to be lightproof with fixed maze-type blades that maintain required lead equivalence at all points and in all directions. Fit and assemble louvers in doors at factory.

2.10 LEAD-LINED HOLLOW-METAL FRAMES

A. Hollow-Metal Frames: Steel frames complying with NAAMM-HMMA 861, except as indicated.

1. Provide borrowed lite observation window frames with mitered and welded corners, allowing frame to be installed after construction of partition.

   a. Construct so lead lining overlaps glazing material perimeter by at least 3/8 inch (9.5 mm) and furnish removable stops.
   b. Form sill with an opening for sound transmission. Offset sound passage to make opening lightproof and to maintain required lead equivalence at all points and in all directions.

2. Provide door and observation window frames from steel sheet with minimum thickness of 0.0667 inch (1.7 mm).
3. Furnish with additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.
4. Line frame with lead sheet of thickness not less than that required for doors and walls where frames are used. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.
5. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

2.11 LEAD-LINED FLUSH WOOD DOORS

A. Lead-Lined Flush Wood Doors: Wood doors complying with AWI "Architectural Woodwork Standards," except as indicated.

1. Performance Grade:

   a. ANSI/WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

B. Solid Core Door Construction: Manufacturer Option, one of the following:

1. Lead-Lined Flush Wood Doors: Solid-core wood doors with lead sheet laminated to each side of core.
   a. Construction: Hot pressed, bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before applying lead lining and faces.
2. Lead-Lined Split-Core Wood Doors: Solid-core wood doors with lead lining in center of core.
   a. Construction: Split core with lead lining in center of core; bonded (vertical and horizontal edging is bonded to core). Assemble lead lining and core with poured-lead fasteners or steel bolts. Space fasteners not more than 1-1/2 inches (38 mm) from door edge and about 8 inches (200 mm) o.c. Countersink bolt heads and cover with lead.
3. Core: Comply with Division 08 Section Solid Core Flush Wood Doors.
4. Lead Lining: Continuous sheets of lead extending from top to bottom and edge to edge; with total lead thickness not less than that required for partition in which door is installed.
5. Wood Veneer Faces: Wood veneer applied to crossbands over core.
   a. Comply with Division 08 Section Solid Core Flush Wood Doors for veneer species, grade, and matching; finishing; and other requirements unless otherwise indicated.
6. Plastic-Laminate Faces: High-pressure decorative laminate complying with ISO 4586-3, Grade HGS; applied to crossbands over core.

C. Lead Door Louvers: Louvers with 30 percent free area, made from formed-lead sheet or lead extrusions of not less than lead thickness required for door in which louver is installed. Fabricate louvers to be lightproof with fixed maze-type blades that maintain required lead equivalence at all points and in all directions. Factory fit and assemble louvers in doors.

D. Prepare doors to receive glazed lights and louvers; factory cut and trim openings through doors. Provide removable wood stops for glazed lights.

E. Metal Frames for Glazed Lights: Lead-lined frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

F. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining.

G. Furnish lead-lined astragals for pairs of doors.

H. Factory fit doors to suit frame openings indicated with 1/16-inch (1.6-mm) clearance at heads and jambs and minimum clearance at bottom. Factory machine doors for hardware not surface applied.

2.12 LEAD-LINED FILM TRANSFER CABINETS

A. General: Factory-fabricated, double-wall construction, of 0.0428 in (1.1 mm) thick, cold-rolled, stretcher-leveled, commercial-quality steel sheet free of scale, buckle, pits, and other defects. Line entire interior and doors with lead sheet thickness not less than that required for partition in which cabinet is installed.
   1. Configuration and Size: 2-compartment, 4-door type unless otherwise indicated.
   2. Provide an integral flange with lead lining extending beyond rough opening at least 3/4 in (19 mm).
   3. Provide a sound passage in cabinet frame. Offset sound passage to make opening lightproof and to maintain required lead equivalence at all points and in all directions.

4. Doors: Mount doors on full-height, concealed-leaf hinges. Label doors to one compartment "EXPOSED" and to other "UNEXPOSED." Provide a manual interlocking device to prevent doors on opposite sides of compartments from being opened at same time.
5. Exterior Finish: Baked-on gray enamel primer.
6. Cabinet Interior: Provide each compartment with a black rubber floor. Finish interior of doors, sides, and top in a nonreflective black finish.
7. Trim: Provide face flange or separate trim on each side of wall.
8. Hardware: Provide bright, polished, chrome-plated brass hardware.
9. Rough-in Frame: Provide adjustable telescoping rough-in frame fabricated from 0.064 in (1.6 mm) thick, zinc-coated steel. Design frame to allow adjustment for wall thicknesses from approximately 4 to 8 in (100 to 200 mm).
10. Support Brackets: Provide two triangular support brackets for each cabinet. Brackets shall be manufactured from 0.0428 in (1 mm) thick steel sheet with flanges for fastening to wall and to cabinet. Finish with baked-on primer.

2.13 NEUTRON-SHIELDING DOORS AND FRAMES

A. General: Steel plate doors lined with lead and borated polyethylene and hung from structural-steel door frames.

1. Shielding Requirements: As indicated on drawings or refer to Owner-provided health physicist report.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
3. Door Construction: Fabricate from 1/4 in (6 mm) thick steel plate faces, reinforced at hinge locations, and 1/2 in (12 mm) thick, steel flat-bar edges fully welded together. Continuously weld exposed joints and finish smooth, matching adjacent surfaces.

   a. Apply filler to interior of door faces to provide smooth, even surfaces for applying lead and polyethylene. Bond lead to interior of door face with permanent adhesive.
   b. Install lead in one piece and polyethylene in single or multiple sheets, all full height and width of door interior.

4. Door Frame Construction: Fabricate from 1/4 in (6 mm) thick steel plate to dimensions indicated, fully welded together. Continuously weld exposed joints and finish smooth, matching adjacent surfaces.

   a. Fabricate frames with depth equal to thickness of shielding wall in which door is installed. Rabbet frame to receive door and to provide a 4 in (100 mm) overlap between door edges and remaining frame depth. Make frame faces 4 in (100 mm) wide with 3/4 in (19 mm) deep backbends.
   b. Provide steel strap anchors using 1/8 by 2 in (3 by 50 mm) wide straps of length required for a minimum 8 in (200 mm) embedment. Weld anchors to frame members not more than 8 in (200 mm) from both bottom and top of jambs and from ends of head, and space anchors not more than 24 in (600 mm) apart.
   c. Provide channel-shaped sill fabricated from 1/4 in (6 mm) thick steel plate lined with lead. Make sill 1-1/2 in (38 mm) deep by same width as jambs and weld to door jambs.

5. Shop-Primed Finish: Prepare ferrous-metal surfaces to comply with SSPC-SP 3 (Power Tool Cleaning) and apply an alkyd primer complying with MPI#79.

   a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

6. Hardware: Provide the following hardware for each door:

a. Hinges: BHMA A156.1, Type A8391; weld- or bolt-on type at manufacturer's option; sized for door weight; two or three per door at manufacturer's option.
b. Pulls: BHMA A156.6, Type J401, two per door.
c. Operator: Power-opening and spring- or power-closing unit; with automatic hold-open; complying with BHMA A156.10; sized for door weight and width; and adjustable for opening, closing, and checking speeds. Unit shall have an emergency release to allow door to be opened manually and a disconnect switch to prevent power operation when door is in emergency-release mode.
d. Controls: Provide two wall-mounted, recessed, push-plate switches for opening door and one push-button switch for closing door. Provide motion or presence sensors to detect persons or objects in path of door and, if these are detected, to stop and reverse action of door operator.

7. Door Interlock Switch: Provide electric switch in frame jamb to prevent operation of radiation therapy equipment when door is open and to shut off power to equipment if door is opened while equipment is in use.

a. Provide rough box for installing switch, fabricated from 1/4 in (6 mm) thick steel plate welded to frame and lined on all sides with 1/4 in (6 mm) thick lead plate.

2.14 INFORMATIONAL SIGNS

A. High-Pressure-Laminate Signs: High-pressure laminate engraving stock with contrasting face and core, machine engraved from master templates for accurately formed letters, numbers, and symbols.

1. Color: As selected by Architect from manufacturer's full range of colors.
2. Provide copy indicated or as directed. Provide signs of sufficient size to contain required information.
3. Indicate lead equivalence in millimeters and heights of radiation protection in inches (millimeters).

B. Rooms Where the Level of Protection is Uniform Throughout: Provide one sign for each room indicating lead equivalence of partitions, ceilings, floors, doors, and other portions of radiation protection enclosure. Indicate height of radiation protection above floor, or indicate that partitions are radiation protected to full height.

C. Rooms Where the Level of Protection is not Uniform Throughout: Provide one sign for each room with different lead equivalences in different locations. Indicate, in tabular form, lead equivalence of each wall, partition, ceiling, floor, door, and window. Indicate height of radiation protection above floor, or indicate that partitions are radiation protected to full height. Indicate where lead equivalence changes or is not continuous.

D. Rooms Where Some Partitions are without Radiation Protection: Provide one sign for each partition that contains radiation protection, and indicate its lead equivalence. Indicate height of radiation protection above floor, or indicate that partitions are radiation protected to full height.

E. Rooms Where Only the Door has Radiation Protection: Provide one sign for each door indicating its lead equivalence.

F. Mounting: Provide manufacturer's standard two-faced tape or adhesive.

2.15 DOOR AND DOOR FRAME FABRICATION

A. Hardware Preparation: Factory prepare doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with door hardware schedule and templates furnished, as specified in Division 08 Section Door Hardware.

2.16 MISCELLANEOUS MATERIALS

A. Glazing Compounds, Gaskets, and Accessories: Comply with requirements in Division 08 Section Glazing.

B. Accessories and Fasteners: Manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.

C. Asphalt Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

D. Asphalt Felt: ASTM D226/D226M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Concrete Surfaces: Proceed with installation only after surfaces are clean, dry, and free of depressions and sharp projections that could damage or penetrate lead sheet.

3.4 INSTALLATION OF LEAD SHEET, STRIP, AND PLATES

A. Proceed with installation only after concrete surfaces are clean, dry, and free of depressions and sharp projections that could damage or penetrate lead sheet.

B. Coat concrete surfaces with asphalt emulsion before installing lead sheet.

C. Lead Sheet, 1/8 Inch (3.18 mm) Thick or Less: Install in a single layer with a 2-inch (50-mm) minimum lap at joints.

D. Lead Sheet More Than 1/8 Inch (3.18 mm) Thick: Install in two or more layers with a 2-inch (50-mm) minimum lap at joints, or in a single layer with joints butted and covered with a 4-inch-(100-mm-) wide lead strip of same thickness.

E. Extend lead sheet at least 12 inches (300 mm) beyond radiation shielding in walls of treatment room.

F. In floor slabs above shielded rooms, where lead sheet is indicated, extend lead sheet at least 12 inches (300 mm) beyond radiation shielding in walls of room below.

G. At door openings, extend lead sheet at least 12 inches (300 mm) beyond radiation protection in walls and at least 12 inches (300 mm) beyond door opening on both sides, except where lead-lined thresholds are provided.

H. After installation, apply two coats of asphalt emulsion on top surface of lead sheet and protect from damage until concrete topping is placed.

3.5 INSTALLATION OF LEAD BRICKS

A. Remove projections from concrete surfaces to receive lead bricks and apply one layer of asphalt felt to prevent contact between lead bricks and concrete.

1. At recesses in concrete floors to receive lead bricks, turn up asphalt felt at perimeter of recess.

B. Install lead bricks to dimensions indicated, tightly fitted together, with joints offset in succeeding courses. Cut bricks neatly at joints with adjacent materials for a snug fit, with edges straight and true and at right angles.

C. Secure lead bricks to support framing or structure, as indicated on approved Shop Drawings.

D. After installation, apply two coats of asphalt emulsion on top surface of lead bricks and protect from damage until concrete topping is placed.

3.6 INSTALLATION OF LEAD-LINED GYPSUM BOARD

A. Install and finish lead-lined gypsum board in accordance with Division 09 Section Gypsum Board Assemblies.

B. Install lead-lined gypsum board panels with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints.

C. Install lead-lined gypsum board panels in sequence, so lead lining that extends beyond edge of gypsum board is covered by next panel installed.

D. At joints where lead lining does not extend beyond edge of gypsum board panels, install lead strips 2 inches (50 mm) wide and same thickness as lead lining to face of framing and blocking. Secure lead strips with construction adhesive.

E. Provide shims at face of supports and blocking, where lead lining does not overlap, to provide a uniform plane across panel surfaces.

F. Fasten lead-lined gypsum board to framing, with steel drill screws spaced as recommended in writing by lead-lined gypsum board manufacturer.

1. Cover fasteners with lead disks recessed flush with surface of board.

G. Two-Layer System: Apply a facing sheet of gypsum board vertically over base sheet, using laminating adhesive recommended in writing by gypsum board manufacturer. Offset joints in finish layer from joints in base layer and fasten at top and bottom of sheet to support finish panel until adhesive has set.

1. Locate fasteners above ceiling or behind wall base. Cover fasteners with lead disks recessed flush with surface of board.

H. Openings: Extend lead-lined gypsum board into frames of openings, lapping lead lining with lead frames or frame linings at least 1 inch (25 mm). Arrange board around openings, so neither horizontal nor vertical joints occur at corners of openings.

I. Install control and expansion joints where indicated, with appropriate trim accessories. Install lead strip on face of framing, extending across joint, and lap with lead lining of gypsum board.

3.7 INSTALLATION OF LEAD-LINED DOORS AND DOOR FRAMES

A. Install lead-lined steel doors and door frames in accordance with Division 08 Section Hollow Metal Doors and Frames.

1. Apply a coat of asphalt mastic or paint to lead lining in door frames where lead comes in contact with masonry or concrete.

B. Install lead-lined wood doors in accordance with Division 08 Section Solid Core Flush Wood Doors.

C. Lead-Lined Hollow-Metal Door Frames: Comply with ANSI/NAAMM-HMMA 840 unless otherwise indicated. Except for frames located in existing walls or partitions, place frames before constructing walls. Set frames accurately in position, plumb, and brace securely until permanent anchors are set.

D. Lead-Lined Observation Windows: Install lead-lined hollow-metal frames, with leaded side of frame on radiation side of wall.

E. Install leaded side of frame on radiation side of wall. Lap lead lining of frames over lining in walls at least 1 inch (25 mm).

F. Lead Glazing: Comply with installation requirements in Division 08 Section Glazing and manufacturer's written instructions.

G. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. Comply with Division 08 Section Door Hardware for additional installation requirements.

1. Line astragals with lead sheet.

3.8 INSTALLATION OF PENETRATING ITEMS

A. At penetrations of lead linings, provide lead shields to maintain continuity of protection.

B. Provide lead linings, sleeves, shields, and other protection in thickness of not less than that required in assembly being penetrated.

C. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners unless indicated on Drawings.

D. Film Transfer Cabinets: Where film transfer cabinets occur in lead-lined partitions, line wall flange with lead sheet of same thickness as required for partition where it is located.

E. Outlet Boxes and Conduit: Cover or line with lead sheet lapped over adjacent lead lining at least 1 inch (25 mm). Wrap conduit with lead sheet for a distance of not less than 10 inches (250 mm) from box.

F. Duct Openings: Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to 3 times the largest opening dimension. Lap lead sheet with adjacent lead lining at least 1 inch (25 mm).

G. Piping: Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than 10 inches (250 mm) from point of penetration.

3.9 INSTALLATION OF NEUTRON-SHIELDING DOORS AND FRAMES

A. Installation of Door in Newly Placed Concrete Wall: Install frames in concrete forms before concrete is placed. Adjust frames as needed so they are square and within 1/16 in (1.5 mm) of plumb. Secure frames to forms and brace to resist forces resulting from concrete placement.

B. Installation of Door in Existing Concrete Wall: Install frames in concrete openings and adjust as needed so they are square and within 1/16 in (1.5 mm) of plumb. Secure frames to concrete and brace to resist forces resulting from weight and movement of shielding door. Grout frames, consolidating grout to solidly fill spaces between frame and opening.

C. Install doors in frames and install door operators, door controls, interlock switches, and other components according to manufacturer's written instructions and Shop Drawings.

D. Touch up damaged primer with compatible coating after sanding smooth.

E. Operation: Rehang or replace doors that do not swing or operate freely. Check and readjust operators and controls for opening, closing, latching, and back-checking speeds and for open- and closed-door positions.

3.10 FIELD QUALITY CONTROL

A. Owner Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections after radiology equipment has been installed and placed in operating condition.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.11 PROTECTION

A. Lock radiation-protected rooms once doors and locks are installed, and limit access to only those persons performing work in the rooms.

3.12 APPENDIX

A. Owner's Radiation Health Physicist Report: Refer to Division 00 Available Project Information.

B. Owner's Radiation Health Physicist Report: Refer to document following this Section.

C. Owner's Radiation Health Physicist Report: Available to Contractor on request.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 134923
RF / MRI MODULAR SHIELDING ENCLOSURE

PART 1 - GENERAL

1.1 SUMMARY

A. Work of this Section includes Radio Frequency (RF) / Magnetic Resonance Imaging (MRI) shielding system and supplementary items necessary to complete the installation.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide manufacturers standard or custom system of products, materials, equipment and components, adapted to the application indicated, that complies with performance requirements specified as demonstrated by testing the manufacturers corresponding systems according to test methods indicated.

B. Performance Responsibility: This is a performance specification and the Contractor shall be responsible for complete design and engineering required, provided by the radio frequency shielding manufacturer to meet specified performance requirements within physical and aesthetic requirements established by the Contract Documents.

C. Contract Documents:

1. Drawings and Specifications are an outline of criteria and performance requirements for radio frequency shielding, and shall not be construed as engineered design. Requirements specified or indicated by details are intended to establish basic aspects of the system, dimensions of module, sight lines and profiles of members.
2. Drawings and Specifications do not necessarily indicate or describe total work required for completion of Work and may not cover some conditions which may be required.
3. Manufacturer may assume Owner will purchase the magnetic resonance imaging medical equipment indicated which shall be the basis of design for the enclosure.

D. Design Responsibility:

1. Manufacturer shall assume undivided responsibility for the design and engineering of each component of the radio frequency shielding, including attachment to the building structure, by employing a design engineer to prepare engineering calculations, shop drawings and other submittals, and other structural data and to inspect the completed installation as indicated under the “Field Quality Control” Article below.
2. The design engineer shall seal the shop drawings, and other submittals prepared under this requirement, according to the respective jurisdictional licensing regulations.

E. Function: The function of the shielding enclosure is to provide a highly conductive medium that will attenuate externally generated electromagnetic energy that complies with the performance requirements required by the manufacturer of the magnetic resonance imaging medical equipment, and will be at a level that is acceptable for the proper operation of the medical equipment.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical data, installation instructions, and recommendations for each product specified. Include data substantiating the materials and performance complies with requirements.

B. Shop Drawings: Submit complete fabrication and erection drawings, consisting of floor and ceiling plans, elevations, details, and schedules that indicate the enclosure, locations of miscellaneous penetrations, other trades that interface with the enclosure, including

mechanical, electrical and plumbing, and any other conditions which will affect the shielded enclosure.

C. Samples for Verification Purposes: Submit samples, no greater than 12 in (300 mm) in every dimension, of each component that describes the shielding system.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers Project Acceptance Document: Submit stating that manufacturer will warrant shielding system for the specific location, design, details, and application indicated for this Project.

B. Field Quality Control Test Reports: Submit written report of testing and inspection as required by the “Field Quality Control Article below which includes, but is not limited to, the following:

1. Testing and inspections performed.
2. Findings of the testing and inspections.
3. Statement that the testing and inspections were performed in accordance with the specified test requirements.
4. Indication whether shielding enclosure has passed or failed the test or inspection.

C. Warranty: Submit sample copy of manufacturers extended warranty, stating obligations, remedies, limitations, and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For inclusion in operation and maintenance manual required by Division 01, submit manufacturers written instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1. The data shall include complete procedure necessary to operate and maintain the enclosures, including trouble shooting, assembly and disassembly of the rooms.
2. The data shall include parts list for spare parts recommended by manufacturer to ensure efficient operation of the enclosure for 1 year normal operation following expiration of the warranty period.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. All products covered under this Section shall be produced by a single manufacturer, unless otherwise specified.
2. Firm shall be experienced in manufacturing products, materials, equipment for shielding systems similar to those indicated for this Project, with not less than 5 years experience, and having completed not less than 10 similar installations within the previous 5 years.

B. Regulatory Requirements for Accessibility: Door unit shall comply with Americans with Disabilities Act (ADA), ANSI A 117.1, and state and local handicapped accessibility standards.

1.7 PROJECT CONDITIONS

A. Space Enclosure and Environmental Limitations: Obtain and comply with shielding manufacturer's recommendations for optimum temperature and humidity conditions for the storage and installation of shielding enclosure within the Project. Store and install products, materials, and equipment only after these conditions have been attained and stabilized [so that temperature and humidity will be within plus or minus 1-percent of optimum moisture content from date of installation through remainder of construction period.

B. Water: Deliver, store and install shielding enclosure only after possibility of water from weather no longer exists (building enclosure, including roof and exterior walls, are in place).

1.8 WARRANTY

A. Extended Warranty: Manufacturer shall warranty against defective materials and workmanship, and that the installed shielded enclosure shall retain the specified shielding characteristics for a period of 5 years from the date of acceptance test, except for moving parts such as doors, which shall be guaranteed for a period of 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Braden Shielding Systems
2. ETS-Lindgren; an ESCO Technologies Co.
3. Gaven Industries, Inc.
4. IMEDCO America Ltd.
5. NELCO
6. Universal Shielding Corp. (USC)

2.2 SYSTEM COMPONENTS

A. Shielding System Enclosure Components: Enclosure shall consist of a proprietary enclosure that includes, but is not limited to, the following:

1. Radio frequency shielding floor, wall, and ceiling plates and panels, including necessary hangers, supports, isolators, structural framing members, panel connectors and fasteners, to assemble a rigid, structurally sound enclosure.
2. Lightweight, easily operated, architecturally styled shielding entry door unit, including door, frame, radio frequency seals (that are easily maintained and replaceable), and conventional hospital quality door hardware, with door and hardware finishes that matches other doors in the area. Door unit shall be rated at a minimum of 50,000 cycles with planned maintenance and without loss of attenuation.
3. Appropriate isolation and grounding provisions.
4. High visibility view window consisting of glass, glazing material and frame.
5. Heating, ventilating and air conditioning wave guides and support hangers.
6. Electrical power and communication line attenuation filters.
7. Wave guide shielded fittings for pipes that penetrate shield.
8. Cryogen gas venting provisions.

2.3 FABRICATION

A. Shop Assembly: Fabricate enclosure, including assembly and finishing, at shop before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive shielding enclosure and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been

corrected in a manner acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 PREPARATION

A. Prepare the structure and area to insure proper and adequate structural support for the shielding enclosure.

3.3 INSTALLATION

A. Install in accordance with magnetic resonance imaging equipment manufacturer's requirements, shielding manufacturer's instructions, approved submittals, and Contract Documents.

B. Coordinate installation with other trades that connect to the enclosure.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

B. Contractor Tests and Inspections:

1. Construction Monitoring: During construction of shielding enclosure, ground isolation shall be monitored at all times, by a ground alert system (audio and visual alarms), to assure that the shielding enclosure is electrically isolated from building ground as specified. Should alarms be registered, the Contractor, with the assistance of the shielding manufacturer, shall promptly correct the problem prior to resuming work on the enclosure.
2. Testing by Shielding Manufacturer:

a. Upon completion of the shielding enclosure, the shielding manufacturer shall test the effectiveness of shielding radio frequency.
b. Tests shall be witnessed by representatives of the Owner, Architect and medical equipment manufacturer.
c. Perform the acceptance test after the enclosure is installed and before any other finished interior, mechanical systems and/or other construction is performed within the shielding enclosure.
d. Perform the qualification test after the interior room construction is complete and the medical equipment is in place. This test must be performed before the medical equipment is energized.
e. Test enclosure (panel seams, door and window) according to applicable provisions of MIL Standard 285 to determine compliance with radio frequency shielding performance requirements required by the medical equipment manufacturer.

3.5 ADJUSTMENTS

A. Adjust and leave the shielding enclosure in proper operational order.

3.6 CLEANING

A. Immediately remove all spots, smears, stains, residues, adhesives, etc., from the work of this Section and/or upon adjacent areas or surfaces which result from the work.

B. Remove damaged items, elements, units or materials and replace with new, undamaged items, elements, units, or materials, all at no cost to the Owner.

3.7 PROTECTION

A. Upon completing work of this Section, institute appropriate procedures for surveillance and protection of shielding enclosure during remainder of construction period

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 142400
HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pre-engineered hydraulic elevators and supplementary items necessary to complete their installation.

1. Hydraulic passenger elevators.
2. Hydraulic service elevators.
3. Designated stretcher elevator complying with code requirements for stretcher.

B. Related Requirements: Including but not limited to the following:

1. Division 05 Section "Structural Steel Framing" for the following:

a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
b. Divider beams.
c. Hoist beams.
d. Structural-steel shapes for subsills.

2. Division 05 Section "Metal Fabrications" for the following:

a. Pit ladders.

1.2 PRODUCT VARIATIONS AND ADJUSTMENTS

A. Product Variations: In the event of differences between products and systems of acceptable or available manufacturer/fabricators, Contractor shall notify Architect of such differences and resolve conflicts prior to awarding Contract. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

B. Adjustments: Proposed deviations shall include a detailed analysis of impact to adjacent substrates, structural, mechanical, electrical or other building systems, including related design or construction cost impacts. Deviations causing changes in materials, constructability, substrates, systems or conditions shall be included in the Work at no additional cost to Owner.

1.3 ALLOWANCES

A. Elevator Car Allowances: Provide finished elevator cars under the Elevator Car Allowance. Allowance includes furnishing and installing the following:

1. Car wall finishes, including trim.
2. Car floor finishes including subfloor and fastening.
3. Car ceiling finishes.
4. Car light fixtures including wiring and coordination of emergency lighting.
5. Handrails.
6. Cutouts and other provisions for installing elevator signal equipment in cars.
7. Mounting for protective pads.

1.4 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

B. Service Elevator: A passenger elevator that is also used to carry freight.

C. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.5 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work:

1. Include large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.

a. Include machine room layout, required clearances and equipment isolation details.
b. Include large-scale layout of car-control station.
c. Include standby power operation control panel.

2. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.
3. Indicate variations from specified requirements.

C. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes, 3-inch- (75-mm-) square Samples of sheet materials and 4-inch (100-mm) lengths of running trim members.

1. Signal Equipment and Fixtures: Architect shall select and approve all fixture selections from Manufacturer's premium fixtures.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room or control closet layout and dimensions, as shown on Drawings, and electrical service including standby power generator if applicable, as shown and specified, are adequate for elevator system being provided.

B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

D. Warranty:

1. Provide manufacturer’s written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. Diagnostic Test Equipment and Instructions: Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44.

a. Provide all diagnostic test devices including one set of supporting information required to interpret test data and troubleshoot system.

2. Maintenance: Vertical transportation system shall designed such that the installation can be maintained by any licensed elevator maintenance company employing journeymen mechanics, without the need to purchase or lease additional diagnostic devices, special tools, or instructions from the original equipment manufacturer.
3. Keys: Provide four sets of keys to operate all keyed switches and locks.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal:

1. Submit a continuing full-service maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar in scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar in scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.9 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review inspection and testing requirements.
   e. Review environmental conditions and procedures for coping with unfavorable conditions.
   f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.11 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

C. Furnish well casing and coordinate delivery with related excavation work.

D. Coordinate locations and dimensions of other work specified in other Sections that relates to hydraulic elevators, including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.12 WARRANTY

A. Manufacturer’s Warranty: Furnish manufacturer’s written material and labor warranty signed by an authorized representative using manufacturer’s standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

   1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
   2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 1 year from date of Substantial Completion.

1.13 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance service by skilled employees of the elevator Installer. Include monthly preventive

maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.

1. Service Records: Installer shall provide a report of all service calls, maintenance service and repairs made during the initial maintenance service period.
2. Perform maintenance, including emergency callback service, during normal working hours with two hour or less response time.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service with one hour or less response time.

B. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

C. Parts: Contractor guarantees to sell parts, including circuit boards, to the Owner or Owner's Agent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. KONE Inc.
2. Otis Elevator Co.
3. Schindler Elevator Corp.
4. TK Elevator.

D. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: <Insert>

2.2 MATERIALS, GENERAL

A. Source Limitations: Obtain elevators, including hydraulic passenger elevators when specified in another Section, from single manufacturer. Provide secondary components and car enclosures only as recommended by manufacturer of primary materials.

1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, are manufactured by single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable provisions of ASME A17.1/CSA B44 "Safety Code for Elevators and Escalators".

C. Accessibility Requirements: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC A117.1 and requirements of authorities having jurisdiction.

D. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to the building code and shall comply with elevator safety requirements for applicable seismic risk Zone in ASME A17.1/CSA B44.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

2.4 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components are used, as included in standard elevator systems and as required for complete system.

B. Elevator(s) Description - Elevator No(s).:

1. Type:

a. Under-the-car single cylinder.
b. Holeless, beside-the-car, telescoping, cylinder.

2. Rated Load: 2000 lb (908 kg).
3. Rated Load: 2500 lb (1135 kg).
4. Rated Load: 3000 lb (1362 kg).
5. Rated Load: 3500 lb (1589 kg).
6. Rated Load: 4000 lb (1816 kg).
7. Rated Load: 4500 lb (2043 kg).
8. Rated Load: 5000 lb (2270 kg).
9. Freight Loading Class for Service Elevators: Class A.
10. Rated Speed: 75 or 80 fpm (0.38 or 0.41 m/s).
11. Rated Speed: 100 fpm (0.51 m/s).
12. Rated Speed: 125 fpm (0.64 m/s).
13. Rated Speed: 150 fpm (0.76 m/s).
14. Rated Speed: 175 fpm (0.89 m/s).
15. Rated Speed: 200 fpm (1.0 m/s).
16. Operational and Supervisory Control System: Microprocessor based
17. Auxiliary Operations:

a. Standby-power operation.
b. Battery-powered lowering.
c. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44
d. Automatic dispatching of loaded car.
e. Nuisance call cancel.
f. Loaded-car bypass.

g. Off-peak operation.
h. Independent service for service elevator and all cars in group.
i. Automatic operation of lights and ventilation fans.
j. Emergency Hospital or Priority Service at all floors.

18. Security Features:

a. Card-reader operation.
b. Car-to-lobby feature.

19. Dual Car-Control Stations: Provide two car-control stations in each elevator; equip only one with required keyswitches.
20. Single Car-Control Stations. Provide one car-control station in elevator.
21. Car Enclosures:

a. As indicated on Drawings.
b. Inside Width: Unless otherwise indicated, Manufacturer's standard for rated load; measured from side wall to side wall.
c. Inside Depth: Unless otherwise indicated, Manufacturer's standard for rated load; measured from back wall to front wall (return panels).
d. Inside Height: Unless otherwise indicated, 108 inches (2700 mm) measured to underside of ceiling.

1) Doghouse: Provide raised section at rear of service car to maximum allowable height.

e. Front Walls (Return Panels) and Car Fixtures:

1) Enameled or powder-coated steel.
2) Polished stainless steel, No. 8 finish.
3) Satin stainless steel, No. 4 finish.
4) Polished bronze, lacquered.
5) Satin bronze, lacquered.

f. Side and Rear Wall Panels and Reveals:

1) Enameled or powder-coated steel.
2) Plastic laminate.
3) Satin stainless steel, No. 4 finish.
4) Textured stainless steel, 5WL finish.
5) Satin bronze, lacquered.

g. Door Faces (Interior):

1) Enameled or powder-coated steel.
2) Polished stainless steel, No. 8 finish.
3) Satin stainless steel, No. 4 finish.
4) Polished bronze, lacquered.
5) Satin bronze, lacquered.

h. Door Sills:

1) Aluminum.
2) Bronze.
3) Nickel silver.

i. Ceiling:

1) Luminous ceiling.
2) Enameled or powder-coated steel.

3) Polished stainless steel, No. 8 finish.
4) Satin stainless steel, No. 4 finish.
5) Polished bronze, lacquered.

j. Handrails: Unless otherwise indicated, 1-1/2 inches (38 mm) round at rear of car.

1) Mirror-polished stainless steel, No. 8 finish.
2) Satin stainless steel, No. 4 finish.
3) Mirror-polished bronze, lacquered.
4) Satin bronze, lacquered.

k. Floor prepared to receive carpet.
l. Floor prepared to receive resilient flooring (Division 9 Section Resilient Flooring).
m. Floor recessed and prepared to receive stone or ceramic tile (Refer to Division 9 Section Tiling).
n. Floor Thickness, Including Setting Materials: Verify thickness above subfloor; coordinate car door sill height with manufacturer.
o. Floor: Stainless steel checkered plate.

22. Hoistway Entrances:

a. Width: Unless otherwise indicated, 42 inches (1050 mm).
b. Height: Unless otherwise indicated, 96 inches (2400 mm).
c. Type:

1) Single-speed side sliding.
2) Two-speed side sliding.
3) Single-speed center opening.
4) Two-speed center opening.

d. Doors and Frames at First Floor:

1) Enameled or powder-coated steel.
2) Primed or powder-coated steel.
3) Polished stainless steel, No. 8 finish.
4) Satin stainless steel, No. 4 finish.
5) Polished bronze, lacquered.
6) Satin bronze, lacquered.

e. Doors and Frames at Other Floors:

1) Enameled or powder-coated steel.
2) Primed or powder-coated stee.l
3) Polished stainless steel, No. 8 finish.
4) Satin stainless steel, No. 4 finish.
5) Polished bronze, lacquered.
6) Satin bronze, lacquered.

f. Sills at First Floor:

1) Aluminum, mill finish.
2) Bronze, polished.
3) Nickel silver, polished.

g. Sills at Other Floors:

1) Aluminum, mill finish.
2) Bronze, polished.
3) Nickel silver, polished.

23. Hall Fixtures:
    a. Polished stainless steel, No. 8 finish.
    b. Satin stainless steel, No. 4 finish.
    c. Polished bronze, lacquered.
    d. Satin bronze, lacquered.
    e. Recessed type with no exposed-metal surfaces.
24. Additional Requirements:
    a. Provide inspection certificate in each car, mounted under acrylic cover with frame matching adjacent metal finish.
    b. Provide hooks for protective pads in all cars and two complete set(s) of full-height protective pads.

C. Elevator(s) Description - Elevator No(s).:
1. Type:
    a. Under-the-car single cylinder.
    b. Holeless, beside-the-car, telescoping, cylinder.
2. Rated Load: 2000 lb (908 kg).
3. Rated Load: 2500 lb (1135 kg).
4. Rated Load: 3000 lb (1362 kg).
5. Rated Load: 3500 lb (1589 kg).
6. Rated Load: 4000 lb (1816 kg).
7. Rated Load: 4500 lb (2043 kg).
8. Rated Load: 5000 lb (2270 kg).
9. Freight Loading Class for Service Elevators: Class A.
10. Rated Speed: 75 or 80 fpm (0.38 or 0.41 m/s).
11. Rated Speed: 100 fpm (0.51 m/s).
12. Rated Speed: 125 fpm (0.64 m/s).
13. Rated Speed: 150 fpm (0.76 m/s).
14. Rated Speed: 175 fpm (0.89 m/s).
15. Rated Speed: 200 fpm (1.0 m/s).
16. Operational and Supervisory Control System: Microprocessor based
17. Auxiliary Operations:
    a. Standby-power operation.
    b. Battery-powered lowering.
    c. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44
    d. Automatic dispatching of loaded car.
    e. Nuisance call cancel.
    f. Loaded-car bypass.
    g. Off-peak operation.
    h. Independent service for service elevator and all cars in group.
    i. Automatic operation of lights and ventilation fans.
    j. Emergency Hospital or Priority Service at all floors.
18. Security Features:
    a. Card-reader operation.
    b. Car-to-lobby feature.
19. Dual Car-Control Stations: Provide two car-control stations in each elevator; equip only one with required keyswitches.

20. Single Car-Control Stations. Provide one car-control station in elevator.
21. Car Enclosures:

    a. As indicated on Drawings.
    b. Inside Width: Unless otherwise indicated, Manufacturer's standard for rated load; measured from side wall to side wall.
    c. Inside Depth: Unless otherwise indicated, Manufacturer's standard for rated load; measured from back wall to front wall (return panels).
    d. Inside Height: Unless otherwise indicated, 108 inches (2700 mm) measured to underside of ceiling.

        1) Doghouse: Provide raised section at rear of service car to maximum allowable height.

    e. Front Walls (Return Panels) and Car Fixtures:

        1) Enameled or powder-coated steel.
        2) Polished stainless steel, No. 8 finish.
        3) Satin stainless steel, No. 4 finish.
        4) Polished bronze, lacquered.
        5) Satin bronze, lacquered.

    f. Side and Rear Wall Panels and Reveals:

        1) Enameled or powder-coated steel.
        2) Plastic laminate.
        3) Satin stainless steel, No. 4 finish.
        4) Textured stainless steel, 5WL finish.
        5) Satin bronze, lacquered.

    g. Door Faces (Interior):

        1) Enameled or powder-coated steel.
        2) Polished stainless steel, No. 8 finish.
        3) Satin stainless steel, No. 4 finish.
        4) Polished bronze, lacquered.
        5) Satin bronze, lacquered.

    h. Door Sills:

        1) Aluminum.
        2) Bronze.
        3) Nickel silver.

    i. Ceiling:

        1) Luminous ceiling.
        2) Enameled or powder-coated steel.
        3) Polished stainless steel, No. 8 finish.
        4) Satin stainless steel, No. 4 finish.
        5) Polished bronze, lacquered.

    j. Handrails: Unless otherwise indicated, 1-1/2 inches (38 mm) round at rear of car.

        1) Mirror-polished stainless steel, No. 8 finish.
        2) Satin stainless steel, No. 4 finish.
        3) Mirror-polished bronze, lacquered.
        4) Satin bronze, lacquered.

    k. Floor prepared to receive carpet.

l. Floor prepared to receive resilient flooring (Division 9 Section Resilient Flooring).
m. Floor recessed and prepared to receive stone or ceramic tile (Refer to Division 9 Section Tiling).
n. Floor Thickness, Including Setting Materials: Verify thickness above subfloor; coordinate car door sill height with manufacturer.
o. Floor: Stainless steel checkered plate.

22. Hoistway Entrances:

a. Width: Unless otherwise indicated, 48 inches (1220 mm).
b. Height: Unless otherwise indicated, 96 inches (2400 mm).
c. Type:

1) Single-speed side sliding.
2) Two-speed side sliding.
3) Single-speed center opening.
4) Two-speed center opening.

d. Doors and Frames at First Floor:

1) Enameled or powder-coated steel.
2) Primed or powder-coated steel.
3) Polished stainless steel, No. 8 finish.
4) Satin stainless steel, No. 4 finish.
5) Polished bronze, lacquered.
6) Satin bronze, lacquered.

e. Doors and Frames at Other Floors:

1) Enameled or powder-coated steel.
2) Primed or powder-coated stee.l
3) Polished stainless steel, No. 8 finish.
4) Satin stainless steel, No. 4 finish.
5) Polished bronze, lacquered.
6) Satin bronze, lacquered.

f. Sills at First Floor:

1) Aluminum, mill finish.
2) Bronze, polished.
3) Nickel silver, polished.

g. Sills at Other Floors:

1) Aluminum, mill finish.
2) Bronze, polished.
3) Nickel silver, polished.

23. Hall Fixtures:

a. Polished stainless steel, No. 8 finish.
b. Satin stainless steel, No. 4 finish.
c. Polished bronze, lacquered.
d. Satin bronze, lacquered.
e. Recessed type with no exposed-metal surfaces.

24. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame matching adjacent metal finish.

b. Provide hooks for protective pads in all cars and two complete set(s) of full-height protective pads.

2.5 SYSTEMS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components, published by manufacturer as included in standard preengineered elevator systems and as required for a complete system.

B. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.

1. Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts.
2. Motor has variable-voltage, variable-frequency control.

C. Oil Cooler: Suitable sized oil cooler units shall be installed on the oil storage tank. Cooler shall be sized to insure oil temperature does not cause "oil odors" in machine room or hoistway; or cause heat "shutdown" of the elevator. Power for oil cooling unit provided by elevator controller.

D. Hydraulic Silencers: System has hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.

E. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.

1. Cylinder units are connected with dielectric couplings.
2. Casing for Underground Piping: Schedule 40 PVC pipe complying with ASTM D1785, joined with PVC fittings complying with ASTM D2466 and solvent cement complying with ASTM D2564.

F. Hydraulic Fluid:

1. Hydraulic Fluid, Manufacturer's Standard: Elevator manufacturer's standard fire-resistant fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.

G. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

H. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1/CSA B44, of sufficient size to provide not less than 1-inch (25-mm) clearance from cylinder and extending above pit floor. Casing has means of monitoring effectiveness to comply with ASME A17.1/CSA B44.

I. Corrosion-Protective Filler: A nontoxic, petroleum-based gel formulated for filling the space between hydraulic cylinder and protective casing. Filler is electrically nonconductive, displaces or absorbs water, and gels or solidifies at temperatures below 60 deg F (16 deg C).

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hydro Safe Oil Division, Inc.; No-Ox-Id Liquid Elevator Casing Filler E-800.
b. Union-Gard, a division of Dome Services L.L.C.; Union-Gard 160.

J. Hoist Beams: Provide framing as indicated in Drawings to support elevator installation. Comply with Division 05 Section "Structural Steel Framing" for materials and fabrication.

K. Car Frame and Platform: Welded steel units.

L. Guides: Provide guides at top and bottom of car frame.

2.6 OPERATION SYSTEMS

A. Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.

1. Firefighter's Service: Provide equipment and operation in accordance with Code requirements and Authorities Having Jurisdiction.

B. Auxiliary Operations:

1. Single-Car Standby-Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby or fire command station. Manual operation causes automatic operation to cease.
2. Single-Car Battery-Powered Automatic Evacuation:

a. If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to a preselected floor, opens its doors, and shuts down. If car is below the preselected floor, it is lowered to the next lower floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

3. Group Standby-Power Operation:

a. On activation of standby power, cars are returned to a designated floor and parked with doors open. Only one car is moved upward at a time, with priority given to loaded cars. If a car cannot be returned after two attempts, it is removed from the system. When all cars have been returned or removed from the system, one car is automatically placed in service. If car selected for service cannot operate within 60 seconds, the system removes car from service and places another car in service. Cars can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby or fire command station. Manual operation causes automatic operation to cease.

4. Group Battery-Powered Automatic Evacuation:

a. If power fails, cars that are at a floor remain at that floor, open their doors, and shut down. Cars that are between floors are lowered to a preselected floor, open their doors, and shut down. Cars that are below the preselected floor are lowered to the next lower floor, open their doors, and shut down. System includes rechargeable battery and automatic recharging system.

5. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors start closing.
6. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
7. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car responds only to car calls, not to hall calls.
8. Off-Peak Operation: During periods of low traffic, half of the elevators in a group are taken out of service and switched to low-power mode.
9. Independent Service: Keyswitch in car-control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.

10. Emergency Hospital or Priority Service: Service is initiated by a card reader at designated floors. One elevator is removed from group operation and directed to the floor where service was initiated. On arriving at the floor, elevator opens its doors and parks. Car is placed in operation by selecting a floor and pressing door close button or by operating keyswitch to put car in independent service. After responding to floor selected or being removed from independent service, car returns to group operation. If car is not placed in operation within a preset time after being called, it is returned to group operation.
11. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after 5 minutes and are re-energized before car doors open.
12. Special Emergency Control – Firefighter's Service: Provide Phase I and Phase II Firefighters' Service; comply with requirements of authorities having jurisdiction and applicable provisions of ASME A17.1/CSA B44 "Safety Code for Elevators and Escalators".
    a. Firefighters Emergency Operation – Phase I Emergency Recall: The activation of a key switch at the designated level hall station shall express return all cars in the group to the designated floor and by-pass all car and hall calls. The cars shall park at the designated floor with the doors open and will not respond to car or hall calls unless the Phase II switch in the car is activated.
    b. Firefighters Emergency Operation - Phase II: In-car key switch control of each elevator during the Emergency operation.

C. Security Features: Security features do not affect emergency firefighters' service.

1. Card-Reader Operation: System uses card readers at car-control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Allow space for card reader in car.
    a. Coordinate requirements with Security access system equipment specified in "Access Control" unless otherwise indicated.
2. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control stations and hall push-button stations. Key is removable only in deactivated position.
3. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car or all cars in a group to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

D. Future Elevator Addition:

1. Future Travel: Certain elevators are indicated to serve future additional landings. Provide these elevators with all controller and other equipment arranged for the indicated number of future landings. Provide position indicators with additional landings included, and blank floor buttons in car operating panels. Make any other provisions necessary including length of jack unit to serve future floors.
2. Future Elevator: Where a future additional elevator is indicated, provide present controller arranged to operate as a group system with the additional new elevator. Include drilling for jack unit and cylinder casing.

E. Electrical Wiring:

1. Furnish and install complete insulated wiring to connect all parts of the equipment. Properly ground all components as required by National Electric Code.

2. Provide 15% spare wires between each controller, selector, hoistway junction box, and control panel; also provide 15% spare conductors in each trail cable; all spares shall be properly tagged or otherwise identified with clear and indelible markings.
3. Provide a total of twelve (12) shielded pairs for communication and security use in the traveling cables for each elevator. The shielded pairs shall be located in a cable which is not used to carry alternating current circuits. The shielded wiring shall extend to a junction box in the elevator controllers in machine room.

2.7 DOOR-REOPENING DEVICES

A. Infrared Array: Provide door-reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams causes doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door-reopening device, a loud buzzer sounds and doors begin to close at reduced kinetic energy.

2.8 CAR ENCLOSURES

A. General: Provide enameled- or powder-coated-steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Elevator Car Finish Allowance: Provide items not included in the Elevator Car Allowance as needed for finished car.

1. Car platform sling, shell, canopy, door, door frame and return panel, shall not be included as a part of this allowance.

C. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor:

a. Carpet or Resilient Flooring: Exterior, underlayment-grade plywood, not less than 5/8-inch (15.9-mm) nominal thickness.
b. Stone or Ceramic Tiling: Exterior, C-C Plugged grade plywood, not less than 7/8-inch (22.2-mm) nominal thickness.

2. Floor Finish:

a. As scheduled or indicated in Design Selections; match samples accepted by Architect.

3. Enameled- or Powder-Coated-Steel Wall Panels: Flush, formed-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel or powder-coat finish; colors as selected by Architect from manufacturer's full range.
4. Stainless Steel Wall Panels: Flush, formed-metal construction; fabricated from stainless steel sheet.
5. Bronze Wall Panels: Flush, formed-metal construction; fabricated from bronze sheet.
6. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch (13-mm) fire-retardant-treated particleboard or manufacturer's standard honeycomb core with plastic-laminate panel backing and manufacturer's standard protective edge trim. Panels have a flame-spread index of 25 or less, when tested according to ASTM E84. Plastic-laminate color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range.
7. Fabricate car with recesses and cutouts for signal equipment.

8. Fabricate car door frame integrally with front wall of car.
9. Enameled- or Powder-Coated-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel or powder-coat finish; colors as selected by Architect from manufacturer's full range.
10. Primed or Powder-Coated-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied, rust-resistant primer or powder coating for field painting.
11. Stainless Steel Doors: Flush, hollow-metal construction; fabricated from stainless steel sheet or by laminating stainless steel sheet to exposed faces and edges of enameled- or powder-coated-steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
12. Bronze Doors: Flush, hollow-metal construction; fabricated by laminating bronze sheet to exposed faces and edges of enameled- or powder-coated-steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
13. Sight Guards: Provide sight guards on car doors.
14. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.
15. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
16. Metal Ceiling: Flush panels, with LED downlights in the center of each panel. Align ceiling panel joints with joints between wall panels.
17. Light Fixture Efficiency: Not less than 35 lumens/W.
18. Ventilation Fan Efficiency: Not less than 3.0 cfm/W (1.4 L/s per W).
19. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.
20. Emergency Exits: Provide emergency exits sized and located in each car in accordance with the Elevator Code.

2.9 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames are self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door-and-frame assemblies comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Protection Rating: 1-1/2 hours.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Frames: Not less than 14 gauge.
2. Doors: Not less than 16 gauge.
3. Enameled- or Powder-Coated-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied enamel or powder-coat finish; colors as selected by Architect from manufacturer's full range.
4. Primed or Powder-Coated-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied, rust-resistant primer or powder coating for field painting.
5. Stainless Steel Frames: Formed from stainless steel sheet.
6. Bronze Frames: Formed from cold- or hot-rolled steel sheet, with enamel or powder-coat finish, and with formed-bronze sheet laminated to steel frames using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
7. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches (76 mm) high, on both jambs of hoistway door frames.

8. Entrance Jamb Plates: Cast metal plates complying with Elevator Code and Accessibility requirements.
9. Enameled- or Powder-Coated-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel or powder-coat finish; colors as selected by Architect from manufacturer's full range.
10. Primed or Powder-Coated-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied, rust-resistant primer or powder-coating for field painting.
11. Stainless Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from stainless steel sheet or by laminating stainless steel sheet to exposed faces and edges of enameled- or powder-coated-steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
12. Bronze Doors and Transoms: Flush, hollow-metal construction; fabricated by laminating bronze sheet to exposed faces and edges of enameled- or powder-coated-steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
13. Sight Guards: Provide sight guards on doors matching door edges.
14. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.
15. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

2.10 SIGNAL EQUIPMENT

A. Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs.

B. Swing-Return Car-Control Stations: Provide car-control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.

1. Unless indicated otherwise, include manufacturer’s premium fixture selection and provide full width swing front return and car operating panels. Logos or manufacturer’s name are not permitted on exposed surfaces.
2. Mark buttons and switches for function. Use both tactile symbols and Braille.
3. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
4. Mount controls at heights complying with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)."
5. Provide two car control stations in each passenger elevator; equip only one with required keyswitches.
6. Provide two car control stations in each elevator with front and rear doors; locating one station at each door; equip only one with required keyswitches.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

1. Provide emergency elevator communication systems for the deaf, hard of hearing and speech impaired when required Code or Authorities Having Jurisdiction.

D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet or telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 Fire-Alarm System.

E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than two stations for each three elevators in a group.

1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
3. Provide Firefighters Emergency Service – Phase I key switch in designated hall station.
4. If required by authorities having jurisdiction, provide telephone jack in each unit for firefighters' two-way telephone communication service.

G. Hall Lanterns: Units with illuminated arrows; however, provide single arrow at terminal landings. Provide one of the following:

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
2. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on cars.

I. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above each hoistway entrance at ground floor.

1. Provide units with flat faceplate for mounting and with body of unit recessed in wall.
2. Integrate ground-floor hall lanterns with hall position indicators.

J. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby-power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

K. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.11 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

1. Car Shell: Not less than 14 gauge.
2. Car Canopy: Not less than 12 gauge.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.

D. Stainless Steel Sheet: ASTM A240/A240M, Type 304.

E. Textured Stainless Steel Sheet: ASTM A240/A240M, Type 304, with embossed texture rolled into exposed surface.

1. Basis of Design: As scheduled or indicated in Design Selections.

F. Stainless Steel Bars: ASTM A276/A276M, Type 304.

G. Stainless Steel Tubing: ASTM A554, Grade MT 304.

H. Bronze Plate and Sheet: ASTM B36/B36M, Alloy UNS No. C28000 (muntz metal).

I. Bronze Extrusions: ASTM B455/B455M, Alloy UNS No. C38500 (architectural bronze).

J. Bronze Tubing: ASTM B135/B135M, Alloy UNS No. C23000 (red brass, 85 percent copper).

K. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063.

L. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500 or No. C77600.

M. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications, Type HGP for post-formed applications and Type BKV for panel backing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates and areas to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Excavation for Cylinder: Drill well hole in each elevator pit to accommodate installation of cylinder.

C. Provide waterproof well casing as necessary to retain well-hole walls.

D. Install cylinder in protective casing within well hole. Before installing protective casing, remove water and debris from well hole and provide permanent waterproof seal at bottom of well casing.

1. Fill void space between protective casing and cylinder with corrosion-protective filler.
2. Align cylinder and fill space around protective casing with fine sand.

E. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between protective casing and pit floor with 4 inches (100 mm) of nonshrink, nonmetallic grout.

F. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

G. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.

H. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

I. Install piping above the floor, where possible. Install underground piping in casing.

J. Lubricate operating parts of systems as recommended by manufacturers.

K. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

L. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and travel direction.

M. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

N. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

3.3 FIELD QUALITY CONTROL

A. Manufacturer/Fabricator's Field Service: Manufacturer/fabricator's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer/fabricator's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

C. Contractor Testing and Inspections:

1. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
2. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Temporary use of elevators for construction purposes is not allowed unless authorized by Owner. Comply with the following requirements for each elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

a. Restore elevator sill(s) to new condition or replace with new sill(s).

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

1. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.

B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

END OF SECTION

SECTION 149100
CHUTES

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes vertical gravity type chutes and supplementary items necessary to complete their installation for the following installations:

1. Waste chutes.
2. Waste chute diverters.
3. Laundry chutes.

1.2 DEFINITIONS

A. Access Door: Door other than an intake or discharge door that penetrates the chase wall for service access to devices in the chase.

B. Chase: The shaft that encloses a chute.

C. Discharge Door: Door or hatch at the bottom of a chute, through which materials exit the chute.

D. Intake Door: Door or hatch that penetrates the chase wall and chute, and through which materials are fed into the chute.

1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

   a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
   b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If

accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer technical literature for each product and system indicated.

1. Include manufacturer specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include each type and location of intake, discharge, and access door.
4. Include diagrams for power, signal and control wiring.

C. Coordination Drawings: Plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Size and construction of chase enclosing each chute; locations for power, signal, and control wiring; and sprinkler-piping and water-service connections.
2. Chute-discharge locations coordinated with compactor-intake or container locations.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturers Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For chutes to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

1.8 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.9 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers/fabricators listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers/fabricators offering products that may be incorporated into the Work include, but are not limited to, those listed.

C. Manufacturers:

1. Midland Chutes.
2. U.S. Chutes.
3. Valiant Products, Inc.

4. Wilkinson Hi-Rise, LLC.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. It is the intent to allow manufacturer to provide a standard system and components adapted to application indicated to the extent that such system complies with the design and performance criteria.

B. Structural Loads: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated including, but not limited to gravity, wind, seismic, and erection design loads and thermal movements established by authorities having jurisdiction, applicable building codes, and as indicated.

C. Structural Movement: Engineer system to withstand movements of supporting structure including, but not limited to inter-story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads.

D. Seismic Performance: Systems shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7, the building code and authorities having jurisdiction

E. Accessibility Standard: Comply with applicable provisions in USDOJ “ADA Standards for Accessible Design", “ABA Accessibility Guidelines”, the local building code and authorities having jurisdiction.

F. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated.

1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
2. Intake Doors: Labeled; 1-1/2-hour fire rated.
3. Access Door: Labeled; 1-1/2-hour fire rated.

G. Discharge-Door Assemblies: Labeled, 1-hour fire-resistance rated according to NFPA 252 or UL 10B requirements for fire-rated door assemblies.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Standard: Provide chutes complying with NFPA 82.

2.4 CHUTES

A. Chute Metal: Aluminum-coated, cold-rolled, commercial steel sheet; ASTM A463/A463M, Type 1, with not less than T1-40 (T1M-120) coating or Type 304 stainless steel, ASTM A240/A240M as recommended by manufacturer.

1. Thickness: Minimum 0.0625 inch (1.587 mm), as recommended by manufacturer.
2. Chute Size: 30-inch (750-mm) diameter, unless indicated otherwise on Drawings.

B. External Reinforcing for Offsets: Additional thickness of 0.11-inch- (1.7-mm-) thick chute metal with bracing to structure.

2.5 DOORS

A. Intake-Door Assemblies: ASTM A240/A240M, Type 304, stainless steel self-closing units with positive latch and latch handle, with stainless steel trim; constructed as required for performance requirements indicated; and with frame suitable for the enclosing chase construction.

1. Door Type, Waste Chutes: Hopper, with embossed letters "RUBBISH".

a. Lockset: Lever-handle-type cylinder lock that releases latch with key that is removable only when cylinder is locked.

1) Lock Cylinder: Cylinders standard with manufacturer.
2) Keying: For each chute, key cylinders alike.
3) Keys: Three for each cylinder.

b. Latchset: Lever-handle type that unlatches door.
c. Accessible Automatic Door Operating System: Manufacturer's standard system complying with applicable provisions of the cited accessibility standard.

2. Door Type, Laundry Chutes: Side hinged. 180-degree swing type, with embossed letters "SOILED LINEN".

a. Lockset: Lever-handle-type cylinder lock that releases latch with key that is removable only when cylinder is locked.

1) Lock Cylinder: Cylinders standard with manufacturer.
2) Keying: For each chute, key cylinders alike.
3) Keys: Three for each cylinder.

b. Latchset: Lever-handle type that unlatches door.
c. Accessible Automatic Door Operating System: Manufacturer's standard system complying with applicable provisions of the cited accessibility standard.

3. Size: Manufacturer's standard size for door type, chute type, and diameter indicated.
4. Finish: Manufacturer's standard satin or ASTM A480/A480M No. 3 directional polish.
5. Mechanical Interlocks: Interlock system for system servicing, operated from discharge door to automatically lock intake doors.
6. Electrical Interlocks: Interlock system that is energized by opening one intake door; remaining intake doors automatically lock when system is energized.

B. Discharge-Door Assemblies, Waste Chutes: Aluminum-coated steel; direct vertical-discharge type, inclined, and horizontally closing and latching; constructed as required for performance requirements indicated; and equipped with fusible links that cause doors to close in the event of fire.

C. Discharge-Door Assemblies, Laundry Chutes: Aluminum-coated-steel doors; horizontal discharge, top-hinged, self-closing and latching, hopper-type door; constructed as required for performance requirements indicated; and equipped with fusible links that cause doors to close in the event of fire; with floor-mounted leg brace designed to absorb impact of material dropping against chute; and with minimum NPS 2 (DN 50) drain pipe connection.

D. Heat- and Smoke-Detector System: Interlock system with temperature-rise elements that locks chute doors when temperature in chute reaches a predetermined, adjustable temperature.

1. Locate smoke detector outside discharge door with solenoid to close discharge door.

E. Access-Door Assemblies: Manufacturer's standard ASTM A240/A240M, Type 302/304, stainless steel doors with trim; constructed as required for performance requirements indicated; with frame suitable for the enclosing chase construction; in satin or ASTM A480/A480M No. 3 directional polish finish; equipped with cylinder locks that release latch with keys that are removable only when cylinder is locked.

F. Manual Control System: Control system with manual switches that lock doors of chute during shutdown hours and service operations.

2.6 DIVERTERS, TRASH CHUTES

A. Diverters: Manufacturer's standard motorized system for distributing materials from one chute into two containers in the discharge room as indicated on Drawings. Integrate diverter controls with controls at intake doors.

B. Construction: Welded steel-plate housing with powered, internal steel blade(s) to deflect materials from chute into appropriate containers.

C. Controls: Integrated, electronic master control unit in discharge room and electronic controls at each intake door, including self-diagnostic program for whole system.

D. Motor Characteristics: Size sufficient to operate diverter blades without exceeding nameplate rating or service factor; complying with NEMA MG 1, as recommended by manufacturer.

E. Recycling Containers: Industry standard, containers for comingled recyclables as recommended by diverter manufacturer for compatibility with diverter system.

2.7 ACCESSORIES

A. Chute Fire Sprinklers: NFPA 13; manufacturer's standard, recessed, automatic, NPS 1/2 (DN 13) sprinklers; ready for piping connections

B. Flushing Spray Unit: NPS 3/4 (DN 19) spray head unit located in chute above highest intake door, ready for hot-water piping connection, and with access for head and piping maintenance.

C. Sanitizing Unit for Trash Chutes: NPS 3/4 (DN 19) disinfecting and sanitizing spray head unit located in chute above highest intake door, including 1-gal. (3.8-L) tank and adjustable proportioning valve with bypass for manual control of sanitizing and flushing operation, ready for hot-water piping connection, and with access for head and piping maintenance.

D. Intake Door Baffles: Rubber baffles, 1/8 inch (3 mm) thick.

E. Sound Dampening: Manufacturer's standard sound deadening coating on exterior of chute and sound and vibration isolator pads at floor supporting frames at each floor penetration.

2.8 FABRICATION

A. General: Factory assemble chutes to greatest extent practical with continuously welded or lock-seamed joints without bolts, rivets, or clips projecting on chute interior. Include intake door assemblies and metal supporting framing at each floor, and chute expansion joints between each support point.

B. Offsets: Construct offsets where indicated on Drawings. Fabricate so that installed chute is without obstructions that might prevent materials from free falling within chute.

1. Offsets below Intake Doors: Unless otherwise indicated, do not exceed a 15-degree maximum offset angle at any point, or place offset closer than 48 inches (1220 mm) to nearest door above offset.
2. Offset above Top Intake Door: Do not exceed a 45-degree maximum offset angle between the highest intake door and the upper termination of chute.

3. Offsets at Floors: Complete offset between floors by returning chute to plumb before penetrating floors.
4. External Reinforcing: Externally reinforce impact area of offsets located below top intake door. Install vibration isolators where braced to structure.

C. Roof Vent: Fabricate vent unit as full-size extension of chute, open to the atmosphere. Extend vent 36 inches (900 mm) above roofing surface unless indicated otherwise on Drawings. Equip vent with full insect screening and metal explosion-release cap. Fabricate with roof-deck flange, counterflashing, and clamping ring of nonferrous metal compatible with chute metal.

1. Flashing and Counterflashing: Refer to the drawings and to Division 07 Section Sheet Metal Flashing and Trim.
2. Roof Curbs: Refer to the drawings and to Division 07 Section Roof Accessories.

D. Chute Fire Sprinklers: Install internally within chute, recessed out of the chute area through which material travels, and according to NFPA 13. Locate fire sprinklers at or above the top intake door of chutes, within the chute at alternate floor levels in buildings more than two stories tall, and at the lowest service level.

1. Water-Service Connections: Refer to the drawings and to Division 22 Plumbing specifications.

E. Equipment Access: Fabricate chutes with access for maintaining equipment located within the chute, such as flushing and sanitizing units, fire sprinklers, and plumbing and electrical connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine roughing-in for electrical systems to verify actual locations of connections before chute equipment installation.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator written installation instructions.
2. Approved submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturers instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF CHUTES

A. Install and test chutes before installing enclosing chase construction.

B. General: Install chutes according to NFPA 82 and manufacturer's written instructions. Assemble components with tight, nonleaking joints. Anchor chutes securely to supporting structure to withstand impacts and stresses. Install chute and components to maintain fire-resistive performance of chute and the enclosing chase construction.

C. Sound Isolation: Mount equipment on vibration-isolating mounts designed to minimize transmission of vibrations to structure and thereby minimize structure-borne noise from chute system.

D. Install chutes plumb, without offsets or obstructions that might prevent materials from free falling within chutes.

E. Coordination with Roofing: Anchor roof flanges of chute vents before installing roofing and flashing. Install chute-vent counterflashing after roofing and roof-penetration flashing are installed.

3.5 INSTALLATION OF DOORS

A. Intake and Discharge Doors: Interface door units with throat sections of chutes for safe, snag-resistant, sanitary depositing of materials in chutes by users.

1. Interconnect sanitizer control with door interlock system.

B. Electrical Interlock System: Comply with applicable NECA 1 recommendations.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

C. Contractor Tests and Inspections: Test chute components and operation after installation. Complete test operations before installing chase enclosures.

1. Chute Operation: Operate doors, locks, and interlock systems to demonstrate that hardware is adjusted and electrical wiring is connected correctly.

2. Inspections: Test heat- and smoke-sensing devices for proper operation.
   a. Fire-rated door inspections: Inspect each fire-rated door according to NFPA 80, section 5.2.
   b. Repair or remove and replace door installations where inspections indicate that they do not comply with specified requirements.
   c. Reinspect repaired or replaced doors to determine if replaced or repaired door installations comply with specified requirements.
   d. Prepare and submit separate inspection report for each fire-rated door indicating compliance with applicable provisions of NFPA 80 and NFPA 101.
3. Plumbing Access Doors: After construction of chase enclosure, verify that access doors have been correctly located and properly installed for their purpose.

3.7 ADJUSTING

A. Adjust doors for smooth and balanced movement.

B. Operate sanitizing unit through one complete cycle of chute use and cleanup, and replenish chemicals or cleaning fluids in unit containers

3.8 CLEANING

A. After completing chase enclosure, clean exposed surfaces of chute system's components. Do not remove labels of independent testing and inspecting agencies.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain each chute and related equipment

B. Demonstrate replenishment of sanitizing-unit chemicals or cleaning fluids.

3.10 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of chute Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper chute and diverter operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   1. Perform maintenance, including emergency callback service, during normal working hours.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 211000

WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following fire-suppression piping inside the building:

1. Wet-pipe sprinkler systems.
2. Description: Extension of existing system to new building area. Expansion is for additional operating rooms.

B. Related Sections include the following:

1. Division 10 Section "Fire Extinguisher Cabinets" and "Fire Extinguishers" for cabinets and fire extinguishers.

C. All black steel sprinkler pipe shall have a wall thickness equal to schedule 40.

1. Exception: Pipe with a nominal pipe size greater than 2-1/2 inches may be schedule 10.

D. Summary Table:

Item	Summary
Underground service entrance piping	Ductile Iron, restrained as required, with thrust blocks, transitioned with bolted flange.
Interior pipe type	Piping 2-1/2 inches or less nominally: Schedule 40 Piping greater than 2-1/2 inches nominally: Schedule 10
Sprinkler Finish	Flat Plate Concealed, except uprights and storage
Extended Coverage	Not Allowed
Center of Tile	Required, Center thirds are acceptable for rectangular tiles
Flexible Sprinkler Drops	Designers' preference
FM Global	Yes Area reduction for quick response sprinklers is not allowed.
Calculations	Required, use reduced flow data

Coordination	All sprinkler piping exposed to view shall be coordinated with the architect prior to final design acceptance.

1.3 DEFINITIONS

A. CPVC: Chlorinated polyvinyl chloride plastic.

B. CR: Chlorosulfonated polyethylene synthetic rubber.

C. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig.

D. PE: Polyethylene plastic.

E. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.

B. Design sprinkler piping according to the following and obtain approval from engineer, prior to submitting to other authorities having jurisdiction:

1. Design sprinkler system with 10% reduced flow data:

   The test shall be performed by the contractor.

2. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.

3. Sprinkler Occupancy Hazard Classifications per FM Global:

   a. General Storage Areas: Hazard Class 1.
   b. Equipment Rooms: Hazard Class 2.
   c. Office and Public Areas: Hazard Class 1.
   d. Operation Rooms: Hazard Class 1.
   e. Exam Rooms: Hazard Class 1.

4. Sprinkler Design Demands for Hazard Categories with ceilings up to 30 ft.:

a. Hazard Class 1-Wet: 0.10 gpm over 1500-sq. ft. area.
b. Hazard Class 2-Wet: 0.20 gpm over 2500-sq. ft. area.
c. Hazard Class 3-Wet: 0.30 gpm over 2500-sq. ft. area.

5. Minimum Sprinkler K-Factors for Hazard Categories with ceilings up to 30 ft.:

a. Hazard Class 1: K5.6, 155 deg. F
b. Hazard Class 2: K8.0, 155 deg. F
c. Hazard Class 3: K11.2, 286 deg. F

6. Maximum Protection Area per Sprinkler: Per FM Approval.

a. Hazard Class 1: 225 sq. ft.
b. Hazard Class 2: 130 sq. ft.
c. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
d. Other Areas: According to FM Global recommendations, unless otherwise indicated

7. Total Combined Hose-Stream Demand Requirement for ceilings under 60 ft. Per FM Global:

a. Hazard Class 1: 250 gpm for 60 minutes.
b. Hazard Class 2: 250 gpm for 60 to 90 minutes.
c. Hazard Class 3: 500 gpm for 90 to 120 minutes.

8. Sprinklers are to be installed throughout the premises, as required by NFPA 13 and FM Global Data Sheet 2-8.

C. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and FM Global Data Sheet 2-8.

1.6 SUBMITTALS

A. Product Data: For the following:
1. Piping materials, including flexible connections and sprinkler specialty fittings.
2. Pipe hangers and supports, including seismic restraints.
3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Fire-hydrant flow test report.

D. Seismic Calculations.

E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable. Drawings are to be approved by Engineer prior to submission to State Fire

Marshal. Drawings are to be submitted to FM Global prior to submission to Engineer.

1. Installation and Fabrication drawings indicating the location of rigid and flexible couplings, seismic separation assemblies, planned clearance cut-outs between piping and solid structural members for seismic movement, and any additional anchoring points required for ceiling systems where sprinklers are fixed or supported in accordance with NFPA and FM Global Data Sheet 2-8.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Welding certificates.

H. Field quality-control test reports.

I. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction. The Engineer requires evidence to support the ability of the contractor to perform work in the scope and volume as specified. A contractor, who cannot show such experience, may be found not suitable to perform the work. The following are the approved contractors for this project:

a. PRE-APPROVED CONTRACTORS LIST
   1) A&D Fire
   2) Alta Fire
   3) Blazemaster Fire Protection
   4) Broken Arrow Fire Protection
   5) Certified Fire
   6) Delta Fire
   7) FireTrol
   8) FireFly Fire Protection
   9) Interwest Fire Protection
   10) Kimco Fire
   11) Quality Fire Protection
   12) Pye Barker Co.
   13) State Fire DC Specialties
   14) Summit Fire & Security
   15) The Safety Team (TST)
   16) Western Automatic Sprinkler Co.
   17) Or prior approved equal

b. A contractor not listed in the “PRE-APPROVED CONTRACTORS LIST” must

receive prior approval from the engineer to bid this project.

B. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET Level III technician.

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

D. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."

2. International Conference of Building Code Officials codes and standards complying with the following:

a. IBC-2021, “International Building Code.”
b. IFC-2021, “International Fire Code.”

E. Utah Amendments
1. Title 15A

F. FM Global Property Loss Prevention Data Sheets:

1. 1-12
2. 2-0
3. 2-8
4. 3-0
5. 3-10
6. 3-26
7. 8-9

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of

sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

1.10 General Engineering Quality

A. Unless noted otherwise the following applies:
   1. The maximum water velocity shall not exceed 32-fps.
   2. Submit the calculations using the reduced flow data.
   3. When calculating flexible drops, the contractor shall use the maximum number of bends for the associated length. The value is to be taken from the UL tests (unless the material is only FM approved).
   4. In the event of multiple (3) submittal rejections (including revise and resubmit) a meeting shall be held at the engineer's office at the engineer time of choosing and the designer, fire sprinkler contractor, and general contractor shall be physically in attendance to discuss the required modifications to the design.

1.11 Contract Completion

A. Incomplete and Unacceptable work:
   1. If additional site visits or design work is required by the Engineer or Architect because of the use of incomplete or unacceptable work by the Contractor, then the Contractor shall reimburse the Engineer and Architect for all additional time and expenses involved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. All products to be FM Global approved.

2.2 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.

   1. Cast-Iron Threaded Flanges: ASME B16.1.
   2. Malleable-Iron Threaded Fittings: ASME B16.3.
   3. Gray-Iron Threaded Fittings: ASME B16.4.
   4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.

5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe not allowed.

1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting not allowed.

C. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe not allowed.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

D. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Anvil International, Inc.
2) Bull Moose Tube Co.
3) Grinnell (Tyco)
4) Victaulic Co. of America.
5) Wheatland Tube

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

E. Threaded-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, is not allowed.

F. Plain-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, is not allowed.

1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting not allowed.

G. Plain-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, is not allowed.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

H. Grooved-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, is not allowed.

I. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 is not allowed.

J. Plain-End, Nonstandard OD, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 10 is not allowed.

K. Plain-End, Hybrid Steel Pipe: ASTM A 135 or ASTM A 795, lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5 is not allowed.

L. Grooved-End, Hybrid Steel Pipe: ASTM A 135 or ASTM A 795, lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5; with factory- or field-formed, roll-grooved ends are not allowed.

M. Schedule 5 Steel Pipe: ASTM A 135 or ASTM A 795, lightwall, with plain ends is not allowed.

2.3 FLEXIBLE SPRINKLER DROPS

A. Flexible connectors shall be FM approved with exterior wire braid and have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:

1. NPS 1: Threaded.

B. Manufacturers:

1. Flex-Head
2. Victaulic

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.4 FLEXIBLE PIPE CONNECTORS (SEISMIC)

A. Flexible connectors shall be FM approved with exterior wire braid and have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:

1. NPS 2 and Smaller: Threaded.
2. NPS 2-1/2 and Larger: Flanged.
3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.

B. Manufacturers:

1. Flexicraft Industries.
2. Flex-Pression, Ltd.
3. Metraflex, Inc.

C. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

D. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

E. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.5 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be FMG approved with 175-psig minimum working-pressure rating, and made of materials compatible with piping.

B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body, with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

1. Manufactures:

a. Central Sprinkler Corp.
b. Fire-End and Croker Corp.
c. Viking Corp.
d. Victaulic Co. of America.

C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

2.6 LISTED FIRE-PROTECTION VALVES

A. Valves shall be FMG approved, with 175-psig minimum pressure rating.

B. Gate Valves with Wall Indicator Posts:

1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with hand wheel, extension rod, locking device, and cast-iron barrel.

3. Manufacturers:

   a. Grinnell Fire Protection.
   b. McWane, Inc.; Kennedy Valve Div.
   c. NIBCO.
   d. Stockham.

C. Ball Valves: Comply with UL 1091, except with ball instead of disc.

1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
3. NPS 3: Ductile-iron body with grooved ends.
4. Manufacturers:

   a. NIBCO.
   b. Victaulic Co. of America.

D. Butterfly Valves: UL 1091.

1. NPS 2 and Smaller: Bronze body with threaded ends.

   a. Manufacturers:

      1) Global Safety Products, Inc.
      2) Milwaukee Valve Company.

2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.

   a. Manufacturers:
      1) Central Sprinkler Corp.
      2) McWane, Inc.; Kennedy Valve Div.
      3) Mueller Company.
      4) NIBCO.
      5) Victaulic Co. of America.

E. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Manufacturers:

   a. American Cast Iron Pipe Co.; Waterous Co.
   b. Central Sprinkler Corp.
   c. Clow Valve Co.
   d. Crane Co.; Crane Valve Group; Crane Valves.
   e. Crane Co.; Crane Valve Group; Jenkins Valves.
   f. Fivalco Inc. dba Aleum USA
   g. Globe Fire Sprinkler Corporation.
   h. Grinnell Fire Protection.

i. Hammond Valve.
j. McWane, Inc.; Kennedy Valve Div.
k. Mueller Company.
l. NIBCO.
m. Potter-Roemer; Fire Protection Div.
n. Reliable Automatic Sprinkler Co., Inc.
o. Star Sprinkler Inc.
p. Stockham.
q. United Brass Works, Inc.
r. Victaulic Co. of America.
s. Watts Industries, Inc.; Water Products Div.

F. Gate Valves: UL 262, OS&Y type.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Manufacturers:

1) Crane Co.; Crane Valve Group; Crane Valves.
2) Fivalco Inc. dba Aleum USA.
3) Hammond Valve.
4) NIBCO.
5) United Brass Works, Inc.

2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

a. Manufacturers:

1) Clow Valve Co.
2) Crane Co.; Crane Valve Group; Crane Valves.
3) Crane Co.; Crane Valve Group; Jenkins Valves.
4) Fivalco Inc. dba Aleum USA
5) Hammond Valve.
6) Milwaukee Valve Company.
7) Mueller Company.
8) NIBCO.
9) United Brass Works, Inc.

G. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch and Visual.
2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.

a. Manufacturers:

1) Fivalco Inc. dba Aleum USA
2) Milwaukee Valve Company.
3) NIBCO.
4) Victaulic Co. of America.

3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

   a. Manufacturers:

      1) Central Sprinkler Corp.
      2) Fivalco Inc. dba Aleum USA
      3) Grinnell Fire Protection.
      4) McWane, Inc.; Kennedy Valve Div.
      5) Milwaukee Valve Company.
      6) NIBCO.
      7) Victaulic Co. of America.

H. Supervised Normally Closed Valve

   1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch and visual to send signal on partial close.

      a. Manufactures:

         1) Fivalco Inc. dba Aleum USA
         2) NIBCO.
         3) Victaulic Co. of America.

2.7 UNLISTED GENERAL-DUTY VALVES

A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.

B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.8 SPECIALTY VALVES

A. Sprinkler System Control Valves: FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.

1. Manufacturers:

a. Globe Fire Sprinkler Corporation.
b. Reliable Automatic Sprinkler Co., Inc.
c. Victaulic Co. of America.
d. Viking Corp.

B. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

1. Manufacturers:

a. Grinnell Fire Protection.

2.9 SPRINKLERS

A. Sprinklers shall be UL listed and FMG approved with 175-psig minimum pressure rating.

B. Manufacturers:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc.
3. Victaulic Co. of America.
4. Viking Corp.
5. Tyco Fire

C. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.
2. UL 1626, for residential applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

1. Open Sprinklers: UL 199, without heat-responsive element.

a. Orifice: 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
b. Orifice: 17/32 inch, with discharge coefficient K between 7.4 and 8.2.

E. Sprinkler types, features, and options as follows:

1. Concealed ceiling sprinklers, including cover plate.
2. Extended-coverage sprinklers, not allowed unless approved in writing prior to bidding.
3. Flush ceiling sprinklers, including escutcheon, not allowed.

4. Pendent sprinklers.
5. Pendent, dry-type sprinklers.
6. Quick-response sprinklers.
7. Sidewall sprinklers.
8. Sidewall, dry-type sprinklers.
9. Upright sprinklers.

F. Sprinkler Finishes: Chrome plated, bronze, and painted. Finishes as approved by FM Global.

G. Special Coatings: Wax, lead, and corrosion-resistant paint.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Flat plate concealed, white.
2. Sidewall Mounting: Flat plate concealed, white.

I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.10 PRESSURE GAGES

A. Manufacturers:

1. Brecco Corporation.
2. Dresser Equipment Group; Instrument Div.
3. Marsh Bellofram.
4. WIKA Instrument Corporation.

B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 250 psig minimum.

1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Obtain Engineer’s Water Analysis or fire-hydrant flow test. Use results for system design calculations required in "Quality Assurance" Article in Part 1 of this Section.

B. Engineer’s Water Analysis. Shall be obtained by the contractor.

3.2 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.3 EXAMINATION

A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS

A. Shop weld pipe joints where welded piping is indicated.

B. Do not use welded joints for galvanized-steel pipe.

C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

D. Sprinkler piping over 2-1/2” inches nominally: Use the following:

1. Schedule 10 steel pipe with roll-grooved ends. No plain ends allowed.
2. Outlets shall be welded.

a. Victaulic Brand Mechanical tee fittings may be used in lieu of welded outlets.

E. Sprinkler piping 2-1/2” and smaller in nominal diameter: Use the following:

1. Schedule 40 steel pipe with threaded ends or roll-grooved ends; ductile-iron threaded fittings or mechanical fittings.

a. Victaulic Brand Mechanical tee fittings may be used

3.5 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13.
2. General-Duty Valves: For applications where UL-listed and FM approved valves are not required by NFPA 13.

a. Shutoff Duty: Use gate, ball, or butterfly valves.
b. Throttling Duty: Use globe, ball, or butterfly valves.

3.6 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Common Work Result for HVAC" for basic piping joint construction.

B. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts

according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.

3.7 PIPING INSTALLATION

A. Refer to Division 23 Section "Common Work Result for HVAC" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls. Refer to Division 23 Section “Common Work Result for HVAC.”

D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.

G. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

J. Hangers and Supports: Comply with NFPA 13 for hanger materials. Install according to NFPA 13 for sprinkler piping.

1. No powder driven studs allowed.
2. Wrap-around braces are to be provided at end of branch lines.

K. Earthquake Protection: Install piping according to NFPA 13-9.3 and FM Global Datasheet 2-8 requirements, to protect from earthquake damage. Seismic Bracing shall be designed to withstand vertical forces and movement.

L. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated, or required by NFPA 13 for flexibility in seismic zones.

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

N. When a fire pipe crosses a seismic expansion joint it shall have a Metraflex fire loop installed at the joint in accordance with NFPA 13 chapter 9.

3.8 SPECIALTY SPRINKLER FITTING INSTALLATION

A. Install specialty sprinkler fittings according to manufacturer's written instructions.

3.9 VALVE INSTALLATION

A. Refer to Division 23 Section "Valves" for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and authorities having jurisdiction.

B. Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.

3.10 SPRINKLER APPLICATIONS

A. General: All sprinklers are to be quick response type. Sprinkler heads shall be of the latest design closed spray type for 155°F unless specified otherwise or required by code. Extended coverage heads shall not be used. Orifices larger than 1/2" may be used as required by density and spacing demands. Use sprinklers according to the following applications:

1. Rooms without Ceilings: Upright and/or pendent sprinklers. Provide mechanical guards on all heads at or below 7’-0” height above the floor or where damage from room occupant use may occur.
2. Rooms with Ceilings: Concealed sprinklers unless indicated otherwise.
3. Wall Mounting: Concealed sidewall sprinklers unless indicated otherwise.
4. Institutional sprinklers shall be installed in areas of detention, correctional or mental health care facilities.
5. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
6. Provide freeze proof type automatic sprinkler heads serving unconditioned spaces, areas subject to freezing and in other areas requiring their use.
7. Heads located within the air streams of unit heaters or other heat-emitting equipment shall be selected for proper temperature rating.
8. Sprinkler Finishes: Use sprinklers with the following finishes:

   a. Upright, Pendent, and Sidewall Sprinklers: Chrome in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
   b. Concealed Sprinklers: Rough brass, with White cover plate to match ceiling color.

B. Sprinklers: Use the following:

1. All sprinklers shall be listed, quick response type.

2. Sprinkler in future finish spaces (shelled) 10’ x 10’ spacing shall be pendents/uprights installed with 1 x ½" bushing, to accommodate future finishes.
3. Finish ceiling spaces shall have flat-plate concealed sprinklers.

3.11 SPRINKLER INSTALLATION

A. Every effort shall be required to ensure that the heads form a symmetrical pattern in the ceiling with the ceiling grid if included, as well as lights, diffusers, and grilles. Offsets shall be made in piping to accommodate ductwork in the ceiling. Heads shall be symmetrical in all ceilings and all piping run parallel or perpendicular to building lines. Heads shall be linearly aligned in corridors.

   1. In no case shall sprinkler heads be installed closer than approved distances from ceiling obstructions and HVAC ductwork.
   2. Sprinkler heads shall not conflict with tile grids.
   3. Sprinkler heads shall be located near center of corridors.

B. Where layout of sprinkler heads is shown on reflected ceiling plans the locations shall be followed unless approval is obtained from the Architect, or such locations shown do not meet the requirements of NFPA-13. In either case, approval of the Architect shall be obtained in writing before sprinkler head locations are changed. If the installation of additional heads is needed to conform to NFPA 13 requirements in areas where heads are shown on reflected ceiling plans, they shall be included in the contract price.

C. Install sprinklers in patterns indicated.

D. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

E. Future finish shelled and tenant finish; Shell spaces shall be piped to accommodate future. Install sprinklers with 1" x ½" bushings, and space heads at a maximum spacing of 100 sq. ft. per head. Occupancy shall be Ordinary-Hazard Group 1 Design.

F. Concealed type sprinkler shall be installed in the following areas:

   1. All areas.

3.12 CONNECTIONS

A. Connect water-supply piping and sprinklers where indicated.

3.13 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 23 Section "Common Work Result for HVAC."

3.14 FIELD QUALITY CONTROL

A. Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.

B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

C. When making a mechanical tee connection the coupon shall be attached at the mechanical tee.

D. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.15 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers having paint other than factory finish.

3.16 PROTECTION

A. Protect sprinklers from damage until Substantial Completion.

3.17 COMMISSIONING

A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.

B. Verify that specified tests of piping are complete, and that “Material Test Certificates” are complete.

C. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.

D. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.

E. Fill wet-pipe sprinkler piping with water.

3.18 DEMONSTRATION & TESTS

A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.

B. All tests will be conducted as required by the local authority having jurisdiction, and in no case less than those required by NFPA standards. As a minimum, piping in the sprinkler system shall be tested at a water pressure at 200 psi for a period of not less two hours, or at 50 psi more than the normal pressure when the normal pressure is above 150 psi. Bracing shall be in place, and air shall be removed from the system through the hydrants and drain valves before the test pressure is applied. No apparent leaks will be permitted on interior or underground piping.

C. The local jurisdiction having authority and the Utah State Fire Marshal's office (where

required) shall be notified at least three working days in advance of all tests and flushing. This includes any flushing of underground, hydrostatic testing, or flow testing that may be required.

D. This contractor shall make all the required tests to the sprinkler system as required by code. He shall be responsible to assure that the Contractor Test Certificates for the overhead, backflow and underground work are completed and delivered to the owner's insurance underwriter to assure proper insurance credit.

E. All tests requiring the witnessing by local authorities will be the responsibility of this contractor. If tests are not run or do not have the proper witness, then they will be run later and all damage caused by the system, or caused in uncovering the system for such test, will be borne by this contractor.

3.19 WARRANTY

A. This contractor shall warranty the sprinkler system and all its components for one year from the date of acceptance by the owner. Any costs incurred to extend any warranties of materials to assure this time frame shall be borne by this contractor.

B. Provide Operation and Maintenance Manuals with correct as-builts test certificates and warranties included. A minimum 6 sets to be provided in red 3-ring binders. Include a current adopted version of NFPA 25 softbound copy left with owner.

C. Electronic copy of AutoCAD as-built drawings shall also be provided on CD, with each O&M Manual.

3.20 FIELD QUALITY CONTROL

A. Flush, test and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.

B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

END OF SECTION 211000

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Painting and finishing.
5. Supports and anchorages.

1.3 SEISMIC REQUIREMENTS

A. Seismic Performance: Equipment, pipe hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 " Vibration and Seismic Controls for Plumbing Piping and Equipment.

1. For components with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. For components with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

1.4 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, and crawlspaces.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms, accessible pipe shafts, accessible plumbing chases and accessible tunnels.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.

PART 3 - EXECUTION

3.1 SEISMIC REQUIREMENTS

A. Comply with SEI/ASCE 7 and with requirements for seismic seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of

piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Sleeves are not required for core-drilled holes.

M. Permanent sleeves are not required for holes formed by removable PE sleeves.

N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using

lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION 220500

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220516

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal-bellows packless expansion joints.
2. Pipe loops and swing connections.
3. Alignment guides and anchors.
4. Flexible-hose packless expansion joints.

1.2 SEISMIC REQUIREMENTS

A. Component Importance Factor. All plumbing components shall be assigned a component importance factor. The component importance factor, I*p*, shall be taken as 1.5 if any of the following conditions apply:

1. The component is required to function for life-safety purposes after an earthquake.
2. The component contains hazardous materials.
3. The component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.

B. All other components shall be assigned a component importance factor, I*p*, equal to 1.0.

C. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 “Vibration and Seismic Controls for Plumbing Piping and Equipment.

1. For components with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."

2. For components with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product certificates.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 PACKLESS EXPANSION JOINTS

A. Metal-Bellows Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Expansion Joint Systems, Inc.
b. Flex-Hose Co., Inc.
c. Flexicraft Industries.
d. Flex Pression Ltd.
e. Flo Fab inc.
f. Hyspan Precision Products, Inc.
g. Metraflex, Inc.
h. Tozen Corporation.
i. Unaflex.
j. Unisource Manufacturing, Inc.
k. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.
l. U.S. Bellows, Inc.

2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
3. Type: Circular, corrugated bellows with external tie rods.
4. Minimum Pressure Rating: 175 psi unless otherwise indicated.
5. Configuration: double joint with base class(es) unless otherwise indicated.
6. Expansion Joints for Copper Tubing: Single- or multi-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.

    a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint or threaded.
    b. End Connections for Copper Tubing NPS 2-1/2 to NPS 8: Solder joint or threaded or flanged.

B. Flexible-Hose Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flex-Hose Co., Inc.
    b. Flexicraft Industries.
    c. Flex Pression Ltd.
    d. Flex-Weld
    e. Fugate
    f. Metraflex, Inc.
    g. Twin City Hose

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with threaded solder-joint end connections.

    a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings. Loops for medical gasses shall be cleaned and capped.

5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded solder-joint end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings. Loops for medical gasses shall be cleaned and capped.

6. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon-steel fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.

7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.

a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

8. Expansion Joints for Steel Piping NPS 8 to NPS 12: Carbon-steel with flanged end connections.

a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F and 90 psig at 600 deg F ratings.

9. Expansion Joints for Steel Piping NPS 14 and Larger: Carbon-steel fittings with flanged end connections.

a. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.

2.2 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Stud: Threaded, zinc-coated carbon steel.
b. Expansion Plug: Zinc-coated steel.
c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

3.2 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

3.3 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.4 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 220516

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Link-Seal
4. Metraflex Company (The).
5. Pipeline Seal and Insulator, Inc.
6. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal

system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
4. For sound-rated partitions, fill the opening between sleeve and piping with insulation prior to sealing.

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
   b. Piping NPS 6 and Larger: Cast-iron wall sleeves.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 220517

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220518

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to 2 inch (50mm), tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type with polished, chrome-plated finish.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with chrome-plated finish.
d. Bare Piping 2 inch and Smaller at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping Larger than 2 inch at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type with polished, chrome-plated finish.
f. Bare Piping 2 inch and Smaller at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping Larger than 2 inch at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type with polished, chrome-plated finish.
h. Bare Piping 2 inch and Smaller in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.
i. Bare Piping Larger than 2 inch in Unfinished Service Spaces: One-piece, stamped-steel type with polished, chrome-plated finish.
j. Bare Piping 2 inch and Smaller in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.
k. Bare Piping in Equipment Rooms Larger than 2 inch: One-piece, stamped-steel type with chrome- or cadmium-plated finish.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.
7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.
9. Tel-Tru Manufacturing Company.
10. Trerice, H. O. Co.

11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
12. Weiss Instruments, Inc.
13. WIKA Instrument Corporation - USA.
14. Winters Instruments - U.S.
15. Weksler

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 5 inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass or plastic.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

   a. Flo Fab Inc.
   b. Miljoco Corporation.
   c. Palmer Wahl Instrumentation Group.
   d. Tel-Tru Manufacturing Company.
   e. Trerice, H. O. Co.
   f. Weiss Instruments, Inc.
   g. Winters Instruments - U.S.
   h. Weksler

2. Standard: ASME B40.200.
3. Case: Cast aluminum 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.

7. Window: Glass or plastic.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

    a. AMETEK, Inc.; U.S. Gauge.
    b. Ashcroft Inc.
    c. Ernst Flow Industries.
    d. Flo Fab Inc.
    e. Marsh Bellofram.
    f. Miljoco Corporation.
    g. Noshok.
    h. Palmer Wahl Instrumentation Group.
    i. REOTEMP Instrument Corporation.
    j. Tel-Tru Manufacturing Company.
    k. Trerice, H. O. Co.
    l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    m. Weiss Instruments, Inc.

n. WIKA Instrument Corporation - USA.
o. Winters Instruments - U.S.
p. Weksler

2. Standard: ASME B40.100.
3. Case: Liquid-filled Open-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Metal or Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACH TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Weksler.
8. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for water service at 20 to 200 deg F shall be CR.
2. Insert material for water service at minus 30 to plus 275 deg F shall be EPDM.

E. Test Kit: Furnish one test kit(s) containing one pressure gage and adaptor, one thermometer, and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F.
3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.

4. Carrying case shall have formed instrument padding.

2.6 ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches into fluid one-third of pipe diameter to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.

I. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

J. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

K. Adjust faces of meters and gages to proper angle for best visibility.

L. Install remote-mounting dial thermometers on panel, with tubing connecting panel and

thermometer bulb supported to prevent kinds. Use minimum tubing length.

M. Install test plugs in tees in piping.

N. Install permanent indicator on walls or brackets in accessible and readable postions.

3.2 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Liquid-filled Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be one of the following:

1. Liquid-filled Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:

1. Liquid-filled Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.

B. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F and 0 to 150 deg C.

3.4 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Liquid-filled Sealed Open-front, pressure-relief, direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Liquid-filled Sealed Open-front, pressure-relief, direct mounted, metal case.

C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:

1. Liquid-filled Sealed Open-front, pressure-relief , direct-mounted, metal case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping 0 to 160 psi and 0 to 1100 kPa.

B. Scale Range for Domestic Water Piping: 0 to 160 psi and 0 to 1100 kPa.

END OF SECTION 220519

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze angle valves.
2. Bronze ball valves.
3. Iron, single-flange butterfly valves.
4. Bronze lift check valves.
5. Bronze swing check valves.
6. Iron swing check valves.
7. Iron swing check valves with closure control.
8. Iron, center-guided check valves.
9. Iron, plate-type check valves.
10. Bronze gate valves.
11. Bronze globe valves.
12. Iron globe valves.
13. Chainwheels.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system

pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hammond Valve.
b. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Valve, Inc.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Crane Co.; Crane Valve Group; Crane Valves.
   d. Hammond Valve.
   e. Lance Valves; a division of Advanced Thermal Systems, Inc.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Red-White Valve Corporation.
   i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Bronze.
   i. Ball: Chrome-plated brass.
   j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Conbraco Industries, Inc.; Apollo Valves.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Hammond Valve.
   d. Lance Valves; a division of Advanced Thermal Systems, Inc.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.

h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

C. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. DynaQuip Controls.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Red-White Valve Corporation.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

D. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
   d. Crane Co.; Crane Valve Group; Jenkins Valves.
   e. Crane Co.; Crane Valve Group; Stockham Division.
   f. DeZurik Water Controls.
   g. Flo Fab Inc.
   h. Hammond Valve.
   i. Kitz Corporation.
   j. Milwaukee Valve Company.
   k. NIBCO INC.
   l. Norriseal; a Dover Corporation company.
   m. Red-White Valve Corporation.
   n. Spence Strainers International; a division of CIRCOR International, Inc.
   o. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: 200 psig.
   c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
   d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
   e. Seat: EPDM.
   f. Stem: One- or two-piece stainless steel.
   g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
   b. American Valve, Inc.
   c. Conbraco Industries, Inc.; Apollo Valves.
   d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
   e. Crane Co.; Crane Valve Group; Center Line.
   f. Crane Co.; Crane Valve Group; Stockham Division.
   g. DeZurik Water Controls.
   h. Flo Fab Inc.
   i. Hammond Valve.
   j. Kitz Corporation.
   k. Milwaukee Valve Company.
   l. Mueller Steam Specialty; a division of SPX Corporation.
   m. NIBCO INC.

n. Norriseal; a Dover Corporation company.
o. Spence Strainers International; a division of CIRCOR International, Inc.
p. Sure Flow Equipment Inc.
q. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated or -coated ductile iron.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Milwaukee Valve Company.
l. Mueller Steam Specialty; a division of SPX Corporation.
m. NIBCO INC.
n. Norriseal; a Dover Corporation company.
o. Red-White Valve Corporation.
p. Spence Strainers International; a division of CIRCOR International, Inc.
q. Sure Flow Equipment Inc.
r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

2.5 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.6 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
l. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.
i. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.7 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Powell Valves.
i. Red-White Valve Corporation.
j. Sure Flow Equipment Inc.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
l. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

B. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 500 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.8 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. NIBCO INC.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed, exterior lever and spring.

2.9 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. APCO Willamette Valve and Primer Corporation.
c. Crispin Valve.
d. DFT Inc.

e. Flo Fab Inc.
f. GA Industries, Inc.
g. Hammond Valve.
h. Metraflex, Inc.
i. Milwaukee Valve Company.
j. Mueller Steam Specialty; a division of SPX Corporation.
k. NIBCO INC.
l. Spence Strainers International; a division of CIRCOR International, Inc.
m. Sure Flow Equipment Inc.
n. Val-Matic Valve & Manufacturing Corp.
o. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Compact wafer.
e. Seat: Bronze.

B. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 300 psig.
c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
d. Style: Compact wafer.
e. Seat: Bronze.

C. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flo Fab Inc.
e. Hammond Valve.
f. Metraflex, Inc.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Sure Flow Equipment Inc.
j. Val-Matic Valve & Manufacturing Corp.

2. Description:

   a. Standard: MSS SP-125.
   b. CWP Rating: 400 psig.
   c. Body Material: ASTM A 126, gray iron.
   d. Style: Compact wafer, spring loaded.
   e. Seat: Bronze.

D. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. APCO Willamette Valve and Primer Corporation.
   b. Crispin Valve.
   c. Val-Matic Valve & Manufacturing Corp.

2. Description:

   a. Standard: MSS SP-125.
   b. CWP Rating: 500 psig.
   c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
   d. Style: Compact wafer, spring loaded.
   e. Seat: Bronze.

2.10 IRON, PLATE-TYPE CHECK VALVES

A. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. APCO Willamette Valve and Primer Corporation.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Flomatic Corporation.
   d. Mueller Steam Specialty; a division of SPX Corporation.

2. Description:

   a. Standard: API 594.
   b. CWP Rating: 200 psig.
   c. Body Design: Wafer, spring-loaded plates.
   d. Body Material: ASTM A 126, gray iron.
   e. Seat: Bronze.

B. Class 150, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. APCO Willamette Valve and Primer Corporation.

b. Crane Co.; Crane Valve Group; Crane Valves.
c. Mueller Steam Specialty; a division of SPX Corporation.
d. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: API 594.
b. CWP Rating: 300 psig.
c. Body Design: Wafer, spring-loaded plates.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Seat: Bronze.

C. Class 250, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crane Co.; Crane Valve Group; Crane Valves.

2. Description:

a. Standard: API 594.
b. CWP Rating: 400 psig.
c. Body Design: Wafer, spring-loaded plates.
d. Body Material: ASTM A 126, gray iron.
e. Seat: Bronze.

D. Class 300, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Mueller Steam Specialty; a division of SPX Corporation.
d. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: API 594.
b. CWP Rating: 500 psig.
c. Body Design: Wafer, spring-loaded plates.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Seat: Bronze.

E. Class 125, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.

b. Cooper Cameron Valves TVB Techno.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. NIBCO INC.
f. Spence Strainers International; a division of CIRCOR International, Inc.
g. Sure Flow Equipment Inc.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: API 594.
b. CWP Rating: 200 psig.
c. Body Design: Wafer, spring-loaded plates.
d. Body Material: ASTM A 126, gray iron.
e. Seat: EPDM or NBR.

F. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: API 594.
b. CWP Rating: 300 psig.
c. Body Design: Wafer, spring-loaded plates.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Seat: EPDM or NBR.

G. Class 250, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Sure Flow Equipment Inc.

2. Description:

a. Standard: API 594.
b. CWP Rating: 400 psig.
c. Body Design: Wafer, spring-loaded plates.
d. Body Material: ASTM A 126, gray iron.
e. Seat: EPDM or NBR.

H. Class 300, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. APCO Willamette Valve and Primer Corporation.
    b. Val-Matic Valve & Manufacturing Corp.

2. Description:

    a. Standard: API 594.
    b. CWP Rating: 500 psig.
    c. Body Design: Wafer, spring-loaded plates.
    d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
    e. Seat: EPDM or NBR.

2.11 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.
    c. Hammond Valve.
    d. Kitz Corporation.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Powell Valves.
    h. Red-White Valve Corporation.
    i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    j. Zy-Tech Global Industries, Inc.
    k. Conbraco
    l. Apollo

2. Description:

    a. Standard: MSS SP-80, Type 1.
    b. CWP Rating: 200 psig.
    c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    d. Ends: Threaded or solder joint.
    e. Stem and Disc: Bronze.
    f. Packing: Asbestos free.
    g. Handwheel: Malleable iron, bronze, or aluminum.

2.12 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Powell Valves.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.
l. Conbraco
m. Apollo

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 500 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

2.13 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.

3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to ball butterfly and plug valve stems.
3. Sprocket Rim with Chain Guides: Aluminum, of type and size required for valve.
4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for ball butterfly gate globe and plug valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or butterfly valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service Globe, angle, ball or butterfly valves.
4. Pump-Discharge Check Valves:

   a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
   b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.
   c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One, Two, or Three piece, full, regular or reduced port, with brass, bronze or stainless-steel trim.
3. Bronze Lift Check Valves: Class 125, bronze disc.
4. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze, ductile-iron or stainless-steel disc.

3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron, Center-Guided Check Valves: Class 125, globe, metal seat.
5. Iron, Plate-Type Check Valves: Class 125; dual plate; metal seat.

3.6 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125 or Class 150, bronze disc.
3. Ball Valves: One, Two or Three piece, full, bronze with bronze or stainless-steel trim.
4. Bronze Swing Check Valves: Class 125 or Class 150, bronze disc.
5. Bronze Globe Valves: Class 125 or Class 150, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Ball Valves: One, Two or Three piece, full or, regular port, bronze with bronze or stainless-steel trim.
3. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze, ductile-iron or stainless-steel disc.
4. Iron Swing Check Valves: Class 125 or Class 250, metal seats.
5. Iron Swing Check Valves with Closure Control: Class 125, lever and spring weight.
6. Iron, Center-Guided Check Valves: Class 125, Class 150, Class 250 or Class 300, compact-wafer, metal seat.
7. Iron, Plate-Type Check Valves: Class 125, Class 150, Class 250 or Class 300; single plate; metal seat.
8. Iron Globe Valves: Class 125 or Class 250.

END OF SECTION 220523

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight

of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 “Vibration and Seismic Controls for Plumbing Piping and Equipment.

1. For components with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."

2. For components with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.
4. Pipe positioning systems.
5. Mechanical Anchors: ICC-ES Evaluation Reports validating ‘Cracked Concrete’ testing per A.C. 193 must be provided for anchors resisting seismic loads and/or supporting life- safety systems including fire sprinkler systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

D. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
4. Seismic calculations and detailed analysis: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate

directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices. Project specific design documentation and calculations shall be prepared and stamped by a registered professional engineer who is responsible for the seismic restraint design and who is licensed in the state where the project is being constructed (ASCE 7, 13.2.1.1).

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel.", AWS D1.4, "Structural Welding Code--Reinforcing Steel." and ASME Boiler and Pressure Vessel Code: Section IX.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. Anvil International.
2. AAA Technology & Specialties Co., Inc.
3. Bergen-Power Pipe Supports.
4. B-Line Systems, Inc.; a division of Cooper Industries.
5. Carpenter & Paterson, Inc.
6. Empire Industries, Inc.
7. ERICO/Michigan Hanger Co.
8. Globe Pipe Hanger Products, Inc.
9. Grinnell Corp.
10. GS Metals Corp.
11. National Pipe Hanger Corporation.
12. PHD Manufacturing, Inc.

13. PHS Industries, Inc.
14. Piping Technology & Products, Inc.
15. Tolco Inc.
16. Simpson Strong-Tie Co.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. Anvil International.
2. B-Line Systems, Inc.; a division of Cooper Industries.
3. ERICO/Michigan Hanger Co.; ERISTRUT Div.
4. GS Metals Corp.
5. Hilti, Inc.
6. Power-Strut Div.; Tyco International, Ltd.
7. Thomas & Betts Corporation.
8. Tolco Inc.
9. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.

5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. MKT Fastening, LLC.
c. Powers Fasteners.
d. Simpson Strong-Tie Co.

B. Mechanical-Expansion Anchors and Concrete Screws: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. For anchors resisting seismic loads and/or supporting life- safety systems including fire sprinkler systems, Anchors shall have been tested for ‘Cracked Concrete’ per A.C. 193 per a valid ICC-ES Evaluation Report. Manufacturers with these anchors have been designated below with: ‘*’

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.
g. Simpson Strong-Tie Co. *

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
   1. Manufacturers:
      a. Anvil International.
      b. ERICO/Michigan Hanger Co.
      c. MIRO Industries.
      d. Unipure

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
   1. Manufacturers:
      a. MIRO Industries.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   1. Manufacturers:
      a. Anvil International.
      b. ERICO/Michigan Hanger Co.
      c. MIRO Industries.
      d. Portable Pipe Hangers.
   2. Base: Stainless steel.
   3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
   4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   1. Manufacturers:
      a. Anvil International.
      b. Portable Pipe Hangers.
   2. Bases: One or more plastic.
   3. Vertical Members: Two or more protective-coated-steel channels.
   4. Horizontal Member: Protective-coated-steel channel.
   5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in

pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system

Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18 or Simpson Blue Banger Concrete insert with UL & FM approvals): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

C. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe

hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Powder actuated fasteners shall not be used for seismic bracing attachments.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. For anchors resisting seismic loads and/or supporting life-safety systems including fire sprinkler systems, anchors shall have been tested for ‘Cracked Concrete’ per A.C. 193 and shall have a valid ICC-ES Evaluation Report

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

H. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger

and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

P. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports. For applications where seismic bracing is required, 'Cracked Concrete' expansion anchors or concrete screws tested per A.C. 193 must be provided for seismic bracing anchorage where post-installed anchors are required.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches .

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220533

HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:

1. Self-regulating, parallel resistance.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BriskHeat.
2. Chromalox.
3. Delta-Therm Corporation.
4. Easy Heat; a division of EGS Electrical Group LLC.
5. Nelson Heat Trace; a division of EGS Electrical Group LLC.
6. Pyrotenax; a brand of Tyco Thermal Controls LLC.
7. Raychem; a brand of Tyco Thermal Controls LLC.
8. Thermon Americas Inc.
9. Trasor Corp.

B. Comply with IEEE 515.1.

C. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

D. Electrical Insulating Jacket: Flame-retardant polyolefin.

E. Cable Cover: Stainless-steel braid and polyolefin outer jacket with ultraviolet inhibitor.

F. Maximum Operating Temperature (Power On): 150 deg F.

G. Maximum Exposure Temperature (Power Off): 185 deg F.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Capacities and Characteristics:

1. Maximum Heat Output: Provide capacities and characteristics as noted on the drawings.

2.2 CONTROLS

A. Pipe-Mounted Thermostats for Freeze Protection:

1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Section 220553 "Identification for Plumbing Piping and Equipment."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:

1. Snow and Ice Melting on Roofs and in Gutters and Downspouts: Self-regulating, parallel-resistance heating cable.

3.3 INSTALLATION

A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating-Cable Installation for Snow and Ice Melting on Roofs and in Gutters and Downspouts: Install on roof and in gutters and downspouts with clips furnished by manufacturer that are compatible with roof, gutters, and downspouts.

C. Electric Heating-Cable Installation for Freeze Protection for Piping:

1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install electric heating cables according to IEEE 515.1.
3. Install insulation over piping with electric cables according to Section 220719 "Plumbing Piping Insulation."
4. Install warning tape on piping insulation where piping is equipped with electric heating cables.

D. Set field-adjustable switches and circuit-breaker trip ranges.

3.4 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

D. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

E. Cables will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed heating cables, including nonheating leads, from damage during construction.

B. Remove and replace damaged heat-tracing cables.

END OF SECTION 220533

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220548

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following restraints and vibration isolation as defined in Section 230548 “Vibration Isolation and Seismic Controls for HVAC” for the following:

1. Plumbing Piping.
2. Plumbing Equipment.

PART 2 - PRODUCTS

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 (NOT USED)

END OF SECTION 220548

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.
7. Ceiling grid

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Blue.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

2.7 CEILING GRID

A. Provide valve identification for all plumbing and med gas valves located above the ceiling on the ceiling grid below the valve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09.

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Low-Pressure, Compressed-Air Piping:

a. Background Color: Comply with ASME A13.1.
b. Letter Color: Comply with ASME A13.1.

2. Medium-Pressure, Compressed-Air Piping:

a. Background Color: Comply with ASME A13.1.
b. Letter Color: Comply with ASME A13.1.

3. Domestic Water Piping:

a. Background Color: Comply with ASME A13.1.
b. Letter Color: Comply with ASME A13.1.

4. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Comply with ASME A13.1.
b. Letter Color: Comply with ASME A13.1.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches, round.
b. Hot Water: 1-1/2 inches, round.
c. Low-Pressure Compressed Air: 1-1/2 inches, round.
d. High-Pressure Compressed Air: 1-1/2 inches, round.

2. Valve-Tag Color:

a. Cold Water: Comply with ASME A13.1.
b. Hot Water: Comply with ASME A13.1.
c. Low-Pressure Compressed Air: Comply with ASME A13.1.

d. High-Pressure Compressed Air: Comply with ASME A13.1.

3. Letter Color:

a. Cold Water: Comply with ASME A13.1.
b. Hot Water: Comply with ASME A13.1.
c. Low-Pressure Compressed Air: Comply with ASME A13.1.
d. High-Pressure Compressed Air: Comply with ASME A13.1.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 220719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Roof drains and rainwater leaders.
5. Supplies and drains for handicap-accessible lavatories and sinks 3.1.

1.3 DEFINITIONS:

A. Refer to Section 220500 “Common Work Results for Plumbing”.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access

panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.8 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.9 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Insulation for below-ambient service requires a vapor-barrier.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553:

1. Type II and ASTM C 1290, Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

I. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A,

a. Without factory-applied jacket with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

J. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; Super-Stik.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 739, Dow Silicone.
b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F .
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
   b. Eagle Bridges - Marathon Industries; 501.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
   d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
   b. Eagle Bridges - Marathon Industries; 570.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F .
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F .
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F .
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system.

a. PVC, Color-Coded by System: 30 mils thick..

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
   b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
   c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

   a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper. 3-mil- thick, heat-bonded polyethylene and kraft paper.
   d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

   e. Factory-Fabricated Fitting Covers:

      1) Same material, finish, and thickness as jacket.
      2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3) Tee covers.
      4) Flange and union covers.
      5) End caps.
      6) Beveled collars.
      7) Valve covers.
      8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

   1. Products: Subject to compliance with requirements, provide one of the following:

      a. ABI, Ideal Tape Division; 428 AWF ASJ.
      b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
      c. Compac Corporation; 104 and 105.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

   2. Width: 3 inches.
   3. Thickness: 11.5 mils.
   4. Adhesion: 90 ounces force/inch in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch in width.
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

   1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:

a. Engineered Brass Company.
b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
c. McGuire Manufacturing.
d. Plumberex.
e. Truebro; a brand of IPS Corporation.
f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:

a. Truebro; a brand of IPS Corporation.
b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at:

   a. 2 inches o.c.
   b. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.

3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide

the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch , and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Insulation shall have a k value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1-1/2 and Smaller: Insulation shall be one of the following;

a. Flexible Elastomeric:

1) 1/2 inch thick

b. Mineral-Fiber, Preformed Pipe Insulation, Type I:

1) 1/2 inch thick

2. NPS 2 and Larger: Insulation shall be one of the following:

a. Flexible Elastomeric:

1) 1/2 inches thick.

b. Mineral-Fiber, Preformed Pipe Insulation:

1) 1/2 inches thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/2 and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I:
1) 1 inch thick.

2. NPS 2 and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I:
1) 1-1/2 inches thick

C. Domestic Chilled Water (Potable):

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Storm water and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1/2 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1/2 inch thick.
b. Mineral-Fiber, Blanket Insulation, Type I: 1/2 inch thick.
c. Drain Manufacturer's Pre-formed bowl Insulation: 1/2 inch thick.

F. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F :

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric:

1) 3/4 inch thick.

b. Mineral-Fiber, Preformed Pipe Insulation, Type I:

1) 3/4 inch thick.

H. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

I. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 2 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

D. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type II: 1 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. PVC:

a. PVC, Color-Coded by System: 30 mils thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. Aluminum, Stucco Embossed: 0.016 inch thick.

3.14 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

B. Related Requirements:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 SEISMIC REQUIREMENTS

A. Seismic Performance: Pipe hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."

1. For piping with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. For piping with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements

of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

1.5 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.6 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager or owner no fewer than two days in advance of proposed interruption of water service.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

C. All piping shall be American made and tested; no import pipe will be permitted.

D. All exposed water supply piping in toilet rooms, custodial rooms and kitchens shall be chromium plated.

E. All piping installed in or passing through a plenum must be plenum rated, fire wrapped, or installed in a metal conduit.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Victaulic Company.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; Piping Specialties Products.
c. Ford Meter Box Company, Inc. (The).
d. JCM Industries.
e. Romac Industries, Inc.
f. Smith-Blair, Inc.; a Sensus company.
g. Viking Johnson.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Nipples and Waterways:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elster Perfection Corporation.
b. Grinnell Mechanical Products; Tyco Fire Products LP.
c. Matco-Norca.
d. Clearflow/Perfection Corp.
e. Precision Plumbing Products, Inc.
f. Victaulic Company.

2. Standard: IAPMO PS 66 or ASTM F-1545-97.
3. Electroplated steel nipple or waterway complying with ASTM F 1545 or ANSI/NSF-61 Compliant.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene or LTHS.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to

layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Division 22 Section "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Division 22 Section "Domestic Water Piping Specialties."

G. Install domestic water piping with 0.25 percent slope downward toward drain and plumb.

1. Piping will be drained seasonally for freeze protection.

H. Install seismic restraints on piping. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping."

R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Division 22 Section "Domestic Water Pumps."

S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Division 22 Section "Meters and Gages for Plumbing Piping."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.

2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples/waterways.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples/waterways.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric nipples/waterways.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Comply with requirements for connection sizes in Division 22 plumbing fixture Sections.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

   a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
   f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
   b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Some piping types and sizes mentioned in this section may not be used on this project.

B. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

C. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

D. All exposed water supply piping in toilet rooms, custodial rooms and kitchens shall be chromium plated.

E. Under-building-slab, domestic water, building-service piping, NPS 3and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, brazed joints and fittings.

F. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type K; wrought-copper, brazed joints and fittings.

G. Aboveground domestic water piping, NPS 2and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- copper, solder-joint fittings; and soldered joints.

H. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- copper, brazed-joint fittings; and brazed joints.
2. Victaulic grooved joints

I. Aboveground domestic water piping, NPS 5 and larger, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- copper, brazed-joint fittings; and brazed joints.
2. Victaulic grooved joints

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball for piping NPS 3 and smaller. Use butterfly or ball, with flanged ends for piping NPS 4 and larger.
2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose bibbs.
9. Wall hydrants.
10. Drain valves.
11. Water hammer arresters.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.
3. Division 22 Section "Pressure Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Co.
b. Cash Acme.
c. Conbraco Industries, Inc.
d. FEBCO; SPX Valves & Controls.
e. Rain Bird Corporation.
f. Toro Company (The); Irrigation Div.
g. Watts Industries, Inc.; Water Products Div.
h. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arrowhead Brass Products, Inc.
b. Cash Acme.
c. Conbraco Industries, Inc.
d. MIFAB, Inc.

e. Prier Products, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Woodford Manufacturing Company.
h. Zurn Plumbing Products Group; Light Commercial Operation.
i. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Flomatic Corporation.
e. Toro Company (The); Irrigation Div.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Accessories:

a. Valves: Ball type, on inlet and outlet.

D. Spill-Resistant Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.
b. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Accessories:

a. Valves: Ball type, on inlet and outlet.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Flomatic Corporation.
e. Watts Industries, Inc.; Water Products Div.
f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved] for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Flomatic Corporation.
e. Watts Industries, Inc.; Water Products Div.
f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; [flanged] <Insert type> for NPS 2-1/2 and larger.
7. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

C. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.
b. Watts Industries, Inc.; Water Products Div.

c. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

D. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cash Acme.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Flomatic Corporation.
e. Ford Meter Box Company, Inc. (The).
f. Honeywell Water Controls.
g. McDonald, A. Y. Mfg. Co.
h. Mueller Co.; Water Products Div.
i. Watts Industries, Inc.; Water Products Div.
j. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1024.
3. Operation: Continuous-pressure applications.
4. Body: Bronze with union inlet.

E. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cash Acme.
b. Lancer Corporation.
c. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1032.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators: (Direct Type)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cash Acme.
b. Conbraco Industries, Inc.

c. Honeywell Water Controls.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze, provide chrome-plated finish if connected to chrome plated or stainless steel piping for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water Control Valves: (Pilot type)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CLA-VAL Automatic Control Valves.
b. Mifab Corp; Beeco.
c. Watts Industries, Inc.; Ames Fluid Control Systems.
d. Watts Industries, Inc.; Watts ACV.
e. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Flo Fab Inc.
c. ITT Industries; Bell & Gossett Div.
d. NIBCO INC.
e. TAC Americas.
f. Taco, Inc.
g. Victaulic
h. Watts Industries, Inc.; Water Products Div.
i. Nexus
j. Bell & Gossett

2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: bronze,
4. Size: Same as connected piping, but not larger than NPS 2.

5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Flo Fab Inc.
c. ITT Industries; Bell & Gossett Div.
d. NIBCO INC.
e. TAC Americas.
f. Watts Industries, Inc.; Water Products Div.
g. Nexus
h. Bell & Gosset

2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Cash Acme.
c. Conbraco Industries, Inc.
d. Honeywell Water Controls.
e. Leonard Valve Company.
f. Powers; a Watts Industries Co.
g. Symmons Industries, Inc.
h. Taco, Inc.
i. Watts Industries, Inc.; Water Products Div.
j. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Rough bronze.

B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:

a. Armstrong International, Inc.
b. Lawler Manufacturing Company, Inc.
c. Leonard Valve Company.
d. Powers; a Watts Industries Co.
e. Symmons Industries, Inc.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
9. Valve Finish: Chrome plated.
10. Piping Finish: Copper.

C. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cash Acme.
b. Conbraco Industries, Inc.
c. Honeywell Water Controls.
d. Lawler Manufacturing Company, Inc.
e. Leonard Valve Company.
f. Powers; a Watts Industries Co.
g. Watts Industries, Inc.; Water Products Div.
h. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1070, thermostatically controlled water tempering valve.
3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

a. Strainers NPS 2 and Smaller: 0.020 inch.

b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

7. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Flo Fab Inc.
c. ITT Industries; Bell & Gossett Div.
d. NIBCO INC.
e. TAC Americas.
f. Taco, Inc.
g. Victaulic
h. Watts Industries, Inc.; Water Products Div.
i. Nexus
j. Bell & Gossett

2.7 OUTLET BOXES

A. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company.
b. Guy Gray Manufacturing Co., Inc.
c. IPS Corporation.
d. LSP Products Group, Inc.
e. Oatey.
f. Plastic Oddities; a division of Diverse Corporate Technologies.
g. Symmons Industries, Inc.
h. Watts Industries, Inc.; Water Products Div.
i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
j. Zurn Plumbing Products Group; Light Commercial Operation.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
4. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
7. Inlet Hoses: Two 60-inch- long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
8. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end.

B. Water Outlet Boxes:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:

a. Acorn Engineering Company.
b. IPS Corporation.
c. LSP Products Group, Inc.
d. Oatey.
e. Plastic Oddities; a division of Diverse Corporate Technologies.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.8 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.9 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company.
b. MIFAB, Inc.
c. Prier Products, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Woodford Manufacturing Company.
h. Zurn Plumbing Products Group; Light Commercial Operation.

i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Operating Keys: Two with each wall hydrant.

2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.11 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMTROL, Inc.
b. Josam Company.
c. MIFAB, Inc.
d. PPP Inc.
e. Sioux Chief Manufacturing Company, Inc.
f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
g. Tyler Pipe; Wade Div.
h. Watts Drainage Products Inc.
i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

G. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

H. Install water hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Reduced-pressure-principle backflow preventers.
3. Double-check backflow-prevention assemblies.
4. Carbonated-beverage-machine backflow preventers.
5. Dual-check-valve backflow preventers.
6. Water pressure-reducing valves.
7. Calibrated balancing valves.
8. Primary, thermostatic, water mixing valves.
9. Primary water tempering valves.
10. Outlet boxes.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."

1. For piping with a seismic importance factor of 1.0 the term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
2. For piping with a seismic importance factor of 1.5 the term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

C. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-sewer" for plastic sewer piping; "NSF-drain" for plastic drain piping, and "NSF-tubular" for plastic continuous waste piping.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting

materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: All cast-iron waste, vent and sewer pipe and fittings shall conform to the requirements of CISPI Standard 301 and ASTM A 888. All products shall be marked with the collective trademark of the Cast Soil Pipe Institute and shall be listed by NSF International or receive prior approval of the engineer. All cast-iron pipe and fittings shall be American made and tested. Non-compliant import cast-iron products will not be permitted. Any non-compliant cast-iron product installed by the contractor on this project will be replaced at the contractor's expense and shall include all repairs, patching, painting and other incidental work required to return the project to its pre-remediation state.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AB&I Foundry
   b. Charoltte Pipe
   c. Tyler Pipe

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ANACO.
   b. Ideal
   c. Mission Rubber Company; a division of MCP Industries, Inc.
   d. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
4. Listing: Couplings shall be listed by NSF International. Each coupling shall be embossed with the NSF seal.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Husky SD 4000.
   b. Clamp-All Corp HI-TORQ 125.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 DOUBLE-CONTAINMENT PIPE AND FITTINGS

A. Piping Materials:

1. PVC Double-Containment Pipe and Fittings:

a. PVC Carrier Pipe: ASTM D1785, Schedule 40 with ASTM D2466 fittings.

1) Piping Color: White.

b. PVC Containment Pipe: ASTM D1785, Schedule 40 with ASTM D2466 fittings.

1) Piping Color: Clear.

c. Supports: Molded supports or disks as supplied by the double containment pipping system manufacturer for the size and piping type specified.

B. Contain-IT PVC secondary containment casing may be used in lieu of Double wall PVC piping system.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms

and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Install seismic restraints on piping. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install underground PVC piping according to ASTM D 2321.

O. Install PVC Double-Containment as required by the manufacturer:

1. All installers should be trained by manufacturer or manufacturer's rep to ensure that proper installation techniques and considerations are followed.

P. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
3. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling or valve and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inchod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for double-containment PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS: 48 inches with 3/8-inchrod.
2. NPS 3: 48 inches with 1/2-inchrod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inchrod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inchrod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inchrod.

I. Install supports for vertical double-containment PVC piping every 48 inches.

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than

required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make fixture and equipment connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed

before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 3 and smaller shall be the following:

1. Hubless, cast-iron soil pipe and fittings CISPI hubless-piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 4 and larger shall be the following:

1. Hubless, cast-iron soil pipe and fittings heavy-duty hubless-piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 3 and smaller shall be the following:

1. Hubless, cast-iron soil pipe and fittings CISPI hubless-piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

E. Aboveground, vent piping NPS 4 and larger shall be the following:

1. Hubless, cast-iron soil pipe and fittings CISPI hubless-piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

F. Aboveground Grease, soil, waste and vent piping shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings heavy-duty hubless-piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

G. Aboveground, soil and waste piping installed above operating rooms, delivery rooms, trauma rooms, nurseries, central kitchens, sterile processing and Class 1 and 2 imaging rooms shall be the following:

1. Double-Containment piping with solvent cement joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

H. Underground Grease, soil, waste and vent piping shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings heavy-duty hubless-piping couplings; and coupled joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. Rated for High Temperatures.

I. Underground, soil, waste, and vent piping NPS 3 and smaller shall be the following:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. All underground waste piping in boiler room shall be rated for high tempereatures.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

J. Underground, soil and waste piping NPS 4 and larger shall be the following:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. All underground waste piping in boiler room shall be rated for high tempereatures.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

K. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221316

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 221319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Through-penetration firestop assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.

B. Related Sections include the following:

1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 SEISMIC REQUIREMENTS

A. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 “Vibration and Seismic Controls for Plumbing Piping and Equipment.

1.4 DEFINITIONS

A. FOG: Fats, oils, and greases.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. Oatey.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Light Commercial Operation.
    g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Body Material: Gray iron.
4. Seepage Flange: Required.
5. Anchor Flange: Not required.
6. Outlet: Bottom.
7. Trap Material: Cast iron>.
8. Trap Pattern: Deep-seal P-trap>.
9. Trap Features: Trap-seal primer valve drain connection>.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ProSet Systems Inc.

3. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
4. Size: Same as connected soil, waste, or vent stack.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

   a. NPS 2: 4-inch- minimum water seal.

b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch > above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Vent Cap Filters:

1. Description: Activated carbon filter in housing for installation at vent terminal as manufactured by Sweet Filter.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

C. Fasteners: Metal compatible with material and substrate being fastened.

D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

C. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

D. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

F. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

G. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

   a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

H. Install deep-seal traps if indicated.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge

into sanitary drainage system.

J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

K. Install vent cap filters on each vent pipe passing through roof.

L. Install wood-blocking reinforcement for wall-mounting-type specialties.

M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

N. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 221413

FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following storm drainage piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.3 DEFINITIONS

A. LLDPE: Linear, low-density polyethylene plastic.

B. PE: Polyethylene plastic.

C. PVC: Polyvinyl chloride plastic.

D. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

B. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 “Vibration and Seismic Controls for Plumbing Piping and Equipment.

1. For components with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."

2. For components with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Controlled-Flow Storm Drainage System: Include calculations, plans, and details.

C. Field quality-control inspection and test reports.

D. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301. All waste, vent, sewer and storm lines shall be soil pipe and fittings that conform to the requirements of CISPI Standard 301, ASTM A ** and shall be marked with the collective trademark of the Cast Soil Pipe Institute or Receive Prior approval of the engineer and manufactured by AB&I Foundry, Tyler Pipe, or Charlotte Pipe. In addition all

Cast iron shall be American made and tested, no “non compliant” import cast iron will be permitted.

B. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Husky HD 2000.
   b. Clamp-All Corp HI-TORQ 80.
   c. Ideal HD
   d. Mission HW.
   e. Tyler Pipe Widebody.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

2.5 DOUBLE-CONTAINMENT PIPE AND FITTINGS

A. Piping Materials:

1. PVC Double-Containment Pipe and Fittings:

   a. PVC Carrier Pipe: ASTM D1785, Schedule 40 with ASTM D2466 fittings.

      1) Piping Color: White.

   b. PVC Containment Pipe: ASTM D1785, Schedule 40 with ASTM D2466 fittings.

      1) Piping Color: Clear.

   c. Supports: Molded supports or disks as supplied by the double containment pipping system manufacturer for the size and piping type specified.

2.6 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

   a. Dallas Specialty & Mfg. Co.
   b. Fernco, Inc.
   c. Logan Clay Products Company (The).

d. Mission Rubber Co.
e. NDS, Inc.
f. Plastic Oddities, Inc.

2. Sleeve Materials:

a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Mission Rubber Co.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground storm drainage piping shall be the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.

C. Aboveground, storm drainage piping installed above operating rooms, delivery rooms, trauma rooms, nurseries, central kitchens, sterile processing and Class 1 and 2 imaging rooms shall be the following:

1. Double-Containment piping with solvent cement joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Underground storm drainage piping shall be the following (to 6” above finished floor):

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Hub-and spigot cast-iron soil pipe, hub-and spigot cast-iron soil pipe fittings, neoprene rubber gasket, and compression joints.

3.3 PIPING INSTALLATION

A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."

B. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

C. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."

E. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.

F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Fire Plumbing."

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

   1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

H. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:

   1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Storm-Drainage Piping: 1 percent downward in direction of flow.

K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Install underground PVC storm drainage piping according to ASTM D 2321.

M. Install PVC Double-Containment as required by the manufacturer:

   1. All installers should be trained by manufacturer or manufacturer's rep to ensure that proper installation techniques and considerations are followed.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities

having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results Plumbing."

B. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inchod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install hangers for double-containment PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

H. Install supports for vertical double-containment PVC piping every 48 inches.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221413

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 221423

STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following storm drainage piping specialties:

1. Cleanouts.
2. Roof drains.
3. Miscellaneous storm drainage piping specialties.
4. Flashing materials.

B. Related Sections include the following:

1. Division 22 Section "Sanitary Waste Piping Specialties" for backwater valves, floor drains, trench drains and channel drainage systems connected to sanitary sewer, air admittance valves, FOG disposal systems, grease interceptors and removal devices, oil interceptors, and solid interceptors.

1.3 DEFINITIONS

A. PUR: Polyurethane plastic.

B. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Sioux Chief Manufacturing Company, Inc
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Div.
   b. Oatey.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Light Commercial Operation.
   h. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Inside calk.
8. Closure: [Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Stainless steel.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.

15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Sioux Chief Manufacturing Company, Inc
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.2 ROOF DRAINS

A. Metal Roof Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: See Schedule at end of this section for drain descriptions:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Sioux Chief Manufacturing Company, Inc
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Standard: ASME A112.21.2M.
4. Body Material Cast iron.
5. Combination Flashing Ring and Gravel Stop: Required.
6. Dome Material: Cast iron.
7. Extension Collars: Required.
8. Underdeck Clamp Required.
9. Sump Receiver: Required.

B. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.

2. Size: Same as connected conductor.

2.3 FLASHING MATERIALS

A. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.

1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

F. Install manufactured, gray-iron downspout boots at grade with top 18 inches above grade. Secure to building wall.

G. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

H. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 224000

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories bathtub/showers showers and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Urinals.
8. Lavatories.
9. Commercial sinks.
10. Bathtubs.
11. Service sinks.

B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
3. Division 22 Section "Emergency Plumbing Fixtures."
4. Division 22 Section "Drinking Fountains and Water Coolers."

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

C. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

D. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

E. FRP: Fiberglass-reinforced plastic.

F. PMMA: Polymethyl methacrylate (acrylic) plastic.

G. PVC: Polyvinyl chloride plastic.

H. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.

2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
3. Slip-Resistant Bathing Surfaces: ASTM F 462.
4. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
5. Stainless-Steel Residential Sinks: ASME A112.19.3.
6. Vitreous-China Fixtures: ASME A112.19.2M.
7. Water-Closet, Flushometer Tank Trim: ASSE 1037.
8. Whirlpool Bathtub Fittings: ASME A112.19.8M.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.
13. NSF61 Appendage G-AB 1953. Lead free potable drinking faucets.

I. Comply with the following applicable standards and other requirements specified for bathtub/shower and shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
4. Faucets: ASME A112.18.1.
5. Hand-Held Showers: ASSE 1014.
6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Manual-Control Antiscald Faucets: ASTM F 444.
9. Pipe Threads: ASME B1.20.1.
10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Manual-Operation Flushometers: ASSE 1037.
5. Plastic Tubular Fittings: ASTM F 409.
6. Brass Waste Fittings: ASME A112.18.2.
7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

8. NSF61 Appendage G-AB 1953. Lead free potable drinking faucets.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Dishwasher Air-Gap Fittings: ASSE 1021.
3. Flexible Water Connectors: ASME A112.18.6.
4. Floor Drains: ASME A112.6.3.
5. Grab Bars: ASTM F 446.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Off-Floor Fixture Supports: ASME A112.6.1M.
8. Pipe Threads: ASME B1.20.1.
9. Plastic Toilet Seats: ANSI Z124.5.
10. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.
4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
5. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Chicago Faucets.
b. T & S Brass and Bronze Works, Inc.
c. Moen, Inc.

2.2 BATHTUB/SHOWER FAUCETS

A. Bathtub/Shower Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:

a. Chicago Faucets.
b. Leonard Valve Company.
c. Moen, Inc.
d. Powers; a Watts Industries Co.
e. Symmons Industries, Inc.
f. T & S Brass and Bronze Works, Inc.

2.3 SHOWER FAUCETS

A. Shower Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Chicago Faucets.
b. Leonard Valve Company.
c. Moen, Inc.
d. Powers; a Watts Industries Co.
e. Symmons Industries, Inc.
f. T & S Brass and Bronze Works, Inc.

2.4 SINK FAUCETS

A. Sink Faucets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Chicago Faucets.
b. T & S Brass and Bronze Works, Inc.
c. Moen, Inc.

2.5 FLUSHOMETERS

A. Flushometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Sloan Valve Company.
b. Zurn Plumbing Products Group; Commercial Brass Operation.

2.6 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bemis Manufacturing Company.
b. Centoco Manufacturing Corp.
c. Church Seats.
d. Olsonite Corp.
e. Sperzel.

2. Description: Toilet seat for water-closet-type fixture.

a. Material: Molded, solid plastic with antimicrobial agent.
b. Configuration: Open front without cover.
c. Size: Elongated.
d. Hinge Type: CK, check.
e. Class: Heavy-duty commercial.
f. Color: White.

2.7 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Engineered Brass Co.
b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
c. McGuire Manufacturing Co., Inc.
d. Plumberex Specialty Products Inc.
e. TCI Products.
f. TRUEBRO, Inc.
g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements. Product shall also meet the ASTM E 84 25/450 smoke and flame rating.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. TRUEBRO, Inc.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

2.8 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.

2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

C. Lavatory Supports:

1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.9 WATER CLOSETS

A. Water Closets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Standard Companies, Inc.
   b. Crane Plumbing, L.L.C./Fiat Products.
   c. Eljer.
   d. Kohler Co.

2.10 URINALS

A. Urinals:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Standard Companies, Inc.
   b. Crane Plumbing, L.L.C./Fiat Products.
   c. Eljer.
   d. Kohler Co.

2.11 LAVATORIES

A. Lavatories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard Companies, Inc.
b. Crane Plumbing, L.L.C./Fiat Products.
c. Eljer.
d. Kohler Co.

B. Stainless Steel Lavatories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Willoughby.
b. Whitehall.

2.12 COMMERCIAL SINKS

A. Commercial Sinks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkay Manufacturing Co.
b. Just Manufacturing Company.

2.13 BATHTUBS

A. Bathtubs

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard Companies, Inc.
b. Crane Plumbing, L.L.C./Fiat Products.
c. Eljer.
d. Kohler Co.

2.14 SERVICE SINKS

A. Service Sinks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard Companies, Inc.
b. Eljer.
c. Kohler Co.
d. Crane Plumbing, L.L.C./Fiat Products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

L. Install toilet seats on water closets.

M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install shower flow-control fittings with specified maximum flow rates in shower arms.

Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

S. Set bathtubs and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

T. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

U. All plumbing fixtures are to be mounted at the height specified on the Architectural drawings.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

D. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 224716

PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pressure water coolers and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite WE 1, Credit WE 2, and Credit WE 3: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to 10 percent of quantity installed for each type and size indicated, but no fewer than 2 of each.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers:

1. Wall mounted:

a. Wheelchair accessible.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkay Manufacturing Co.
b. Halsey Taylor.
c. Haws Corporation.
d. Larco Inc.

3. Cabinet:

a. Bi-level with two attached cabinets
1) Vinyl-covered steel with stainless-steel top

4. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
5. Control:

a. Push bar.

6. Drain: Grid with NPS 1-1/4 tailpiece.
7. Supply: NPS 3/8 with shutoff valve.
8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

11. Support: ASME A112.6.1M, Type I water-cooler carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224716

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 226113

COMPRESSED-AIR PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Medical compressed-air piping, designated "medical air."
2. Healthcare laboratory compressed-air piping, designated "compressed air."

B. Related Requirements:

1. Section 115313 "Laboratory Fume Hoods" for compressed-air outlets in laboratory fume hoods.
2. Section 123553 "Laboratory Casework" for compressed-air outlets in laboratory casework.
3. Section 123570 "Healthcare Casework" for compressed-air outlets in healthcare casework.
4. Section 226119 "Compressed-Air Equipment for Laboratory and Healthcare Facilities" for air compressors and specialties.
5. Section 226400 "Medical Gas Alarms" for combined medical air, vacuum, and gas alarms.

1.3 DEFINITIONS

A. Medical compressed-air piping systems include medical air, and, compressed air.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Review reports for testing agency's review of construction documents.

C. Seismic Qualification Certificates: For medical compressed-air manifolds, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of

assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Material Certificates: Signed by Installer certifying that medical compressed-air piping materials comply with requirements in NFPA 99 for positive-pressure medical gas systems.

E. Brazing certificates.

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quick-Coupler Service Connections: Furnish complete noninterchangeable medical compressed-air pressure outlets.

a. Medical Air: Equal to 10 percent of amount installed.
b. Instrument Air: Equal to 10 percent of amount installed.

2. D.I.S.S. Service Connections: Furnish complete medical compressed-air pressure outlets complying with CGA V-5.

a. Medical Air D.I.S.S. No. 1160: Equal to 10 percent of amount installed, but no fewer than 10 units.
b. Instrument Air D.I.S.S. No. 1160: Equal to 10 percent of amount installed, but no fewer than 10 units.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Medical Air Piping Systems for Healthcare Facilities: According to ASSE Standard #6010 for medical-gas-system installers.
2. Shape-Memory-Metal Coupling Joints: An authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.

C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Medical air operating at 50 to 55 psig.

B. Compressed air operating at 145 psig.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Medical compressed-air manifolds shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and with the requirements specified in Section 220548 Vibration and Seismic Controls for Plumbing Piping and Equipment.

1. The term "withstand" means "the manifold will remain in place without separation of any parts when subjected to the seismic forces specified and the manifold will be fully operational after the seismic event."
2. Component Importance Factor is 1.5.

2.3 PIPES, TUBES, AND FITTINGS

A. Comply with NFPA 99 for medical air piping materials.

B. Comply with ASME B31.9, "Building Services Piping," for compressed air piping operating at 150 psig or less.

C. Copper Medical Gas Tube: ASTM B 819, Type K and Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and in blue for Type L tube.

D. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type that has been manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.

E. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.

F. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.

1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, full-face type.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.

G. Shape-Memory-Metal Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aerofit, Inc.
b. Smart Tap, Inc.

2. Description: Cryogenic compression fitting made of nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.

H. Flexible Pipe Connectors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flex-Hose Co., Inc.
b. Flexicraft Industries.
c. Hyspan Precision Products, Inc.
d. Mercer Gasket & Shim, Inc.
e. Metraflex Company (The).
f. Proco Products, Inc.
g. Unaflex.
h. Universal Metal Hose; a Hyspan Co.

2. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

a. Working-Pressure Rating: 200 psig minimum.
b. End Connections: Plain-end copper tube.

2.4 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.

B. Threaded-Joint Tape: PTFE.

2.5 VALVES

A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.

B. Zone-Valve Box Assemblies: Box with medical gas valves, tube extensions, and gages.

1. Zone-Valve Boxes:

a. Steel Box with Aluminum Cover:

1) Manufacturers: Subject to compliance with requirements, provide products

by one of the following:

a) Allied Healthcare Products Inc.
b) Amico Corporation.
c) BeaconMedaes
d) Ohio Medical Corporation.
e) Patton's Medical
f) Powerex, Inc.

b. Description: Formed steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves. Medical air and medical vacuum tubing, valves, and gages may be incorporated in zone valve boxes for medical gases.

1) Interior Finish: Factory-applied white enamel.
2) Cover Plate: Aluminum with frangible or removable windows.
3) Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Healthcare Products Inc.; Chemetron Division.
b. Amico Corporation.
c. BeaconMedaes.
d. Conbraco Industries, Inc.
e. Marwin Valve; a division of Richards Industries.
f. NIBCO INC.
g. Ohio Medical Corporation.
h. Patton's Medical
i. Powerex, Inc.
j. Tri-Tech Medical Inc.

2. Standard: MSS SP-110.
3. Description: Three-piece body, brass or bronze.
4. Pressure Rating: 300 psig minimum.
5. Ball: Full-port, chrome-plated brass.
6. Seats: PTFE or TFE.
7. Handle: Lever type with locking device.
8. Stem: Blowout proof with PTFE or TFE seal.
9. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

D. Check Valves:

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:

a. Allied Healthcare Products Inc.; Chemetron Division.

b. Amico Corporation.
c. BeaconMedaes.
d. Conbraco Industries, Inc.
e. Ohio Medical Corporation.
f. Patton's Medical
g. Powerex, Inc.
h. Tri-Tech Medical Inc.

2. Description: In-line pattern, bronze.
3. Pressure Rating: 300 psig minimum.
4. Operation: Spring loaded.
5. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

E. Safety Valves:

1. Bronze body.
2. ASME-construction, poppet, pressure-relief type.
3. Settings to match system requirements.

F. Pressure Regulators:

1. Bronze body and trim.
2. Spring-loaded, diaphragm-operated, relieving type.
3. Manual pressure-setting adjustment.
4. Rated for 250-psig minimum inlet pressure.
5. Capable of controlling delivered air pressure within 0.5 psig for each 10-psig inlet pressure.

2.6 MEDICAL COMPRESSED-AIR SERVICE CONNECTIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Healthcare Products Inc.; Chemetron Division.
2. Amico Corporation.
3. BeaconMedaes.
4. Ohio Medical Corporation.
5. Oxequip Health Industries; a division of Allied Healthcare Products Inc.
6. Patton's Medical
7. Powerex, Inc.
8. Tri-Tech Medical Inc.

B. General Requirements for Medical Compressed-Air Service Connections:

1. Suitable for specific medical air pressure and service listed.
2. Include roughing-in assemblies, finishing assemblies, and cover plates.
3. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate.
4. Recessed-type units made for concealed piping unless otherwise indicated.

C. Roughing-in Assembly:

1. Steel outlet box for recessed mounting and concealed piping.
2. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed.
3. Double seals that will prevent air leakage.
4. ASTM B 819, NPS 3/8 copper outlet tube brazed to valve with service marking and tube-end dust cap.

D. Finishing Assembly:

1. Brass housing with primary check valve.
2. Double seals that will prevent air leakage.
3. Cover plate with gas-service label.

E. Quick-Coupler Pressure Service Connections:

1. Outlets for medical air and instrument air with noninterchangeable keyed indexing to prevent interchange between services.
2. Constructed to permit one-handed connection and removal of equipment.
3. With positive-locking ring that retains equipment stem in valve during use.

F. D.I.S.S. Pressure Service Connections: Outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.

1. Medical Air: D.I.S.S. No. 1160.
2. Instrument Air: D.I.S.S. No. 1160.

G. Cover Plates:

1. One piece.
2. Aluminum or stainless steel.
3. Permanent, color-coded, identifying label matching corresponding service.

2.7 MEDICAL COMPRESSED-AIR PRESSURE CONTROL PANELS

A. Manufacturers: Subject to compliance with requirements provide products by one of the following:

1. Allied Healthcare Products Inc.; Chemetron Division.
2. Amico Corporation.
3. BeaconMedaes.
4. Patton’s Medical
5. Powerex, Inc.

B. Description:

1. Steel box and support brackets for recessed roughing-in with stainless-steel or anodized-aluminum cover plate with printed operating instructions.
2. Manifold assembly consisting of inlet supply valve, inlet supply pressure gage, line-pressure control regulator, outlet supply pressure gage, D.I.S.S. service connection, and piping outlet for remote service connection.

3. Minimum Working Pressure: 200 psig.
4. Line-Pressure Control Regulator: Self-relieving diaphragm type with precision manual adjustment.
5. Pressure Gages: 0 to 300 psig.
6. Service Connection: CGA V-5, D.I.S.S. No. 1160, instrument air outlet.
7. Before final assembly, provide temporary dust shield and U-tube for testing.
8. Label cover plate "Air Pressure Control."

2.8 NITROGEN

A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1.
2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.

   a. Scrub to ensure complete cleaning.
   b. Rinse with clean, hot water to remove cleaning solution.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Comply with NFPA 99 for installation of compressed-air piping.

C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.

F. Install piping adjacent to equipment and specialties to allow service and maintenance.

G. Install compressed-air piping with 1 percent slope downward in direction of flow.

H. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.

I. Install eccentric reducers, if available, where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

J. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

K. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 220519 "Meters and Gages for Plumbing Piping."

L. Install piping to permit valve servicing.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and for branch connections.

O. Install medical air piping to medical air service connections specified in this Section, to medical air service connections in equipment specified in Section 226313 "Gas Piping for Laboratory and Healthcare Facilities," and to equipment specified in other Sections requiring medical air service.

P. Piping Restraint Installation: Install seismic restraints on compressed-air piping. Seismic-restraint devices are specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

Q. Install compressed-air service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.

R. Connect compressed-air piping to air compressors and to compressed-air outlets and equipment requiring compressed-air service.

S. Install unions in copper compressed-air tubing adjacent to each valve and at final connection to each machine, specialty, and piece of equipment.

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 VALVE INSTALLATION

A. Install shutoff valve at each connection to and from compressed-air equipment and specialties.

B. Install check valves to maintain correct direction of compressed-air flow from compressed-air equipment.

C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.

D. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.

E. Install pressure regulators on compressed-air piping where reduced pressure is required.

F. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.

3.4 JOINT CONSTRUCTION

A. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.

B. Threaded Joints: Apply appropriate tape to external pipe threads.

C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Continuously purge joint with oil-free dry nitrogen during brazing.

D. Flanged Joints: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

E. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

3.5 COMPRESSED-AIR SERVICE COMPONENT INSTALLATION

A. Install compressed-air pressure control panel in walls. Attach to substrate.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

C. Vertical Piping: MSS Type 8 or Type 42, clamps.

D. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
2. Longer Than 100 Feet: MSS Type 43, adjustable, roller hangers.

E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.

F. Base of Vertical Piping: MSS Type 52, spring hangers.

G. Support horizontal piping within 12 inches of each fitting and coupling.

H. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch- minimum rods.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4: 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
3. NPS 3/4: 84 inches with 3/8-inch rod.
4. NPS 1: 96 inches with 3/8-inch rod.
5. NPS 1-1/4: 108 inches with 3/8-inch rod.
6. NPS 1-1/2: 10 feet with 3/8-inch rod.
7. NPS 2: 11 feet with 3/8-inch rod.
8. NPS 2-1/2: 13 feet with 1/2-inch rod.
9. NPS 3: 14 feet with 1/2-inch rod.
10. NPS 3-1/2: 15 feet with 1/2-inch rod.
11. NPS 4: 16 feet with 1/2-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

3.7 IDENTIFICATION

A. Install identifying labels and devices for medical compressed-air piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:

1. Medical Air: Black letters on yellow background.
2. Compressed Air: Black letters on yellow-and-white checkerboard background.

3.8 FIELD QUALITY CONTROL FOR MEDICAL COMPRESSED-AIR PIPING IN HEALTHCARE FACILITIES

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections of medical compressed-air piping in healthcare facilities and to prepare test and inspection reports.

B. Review of Construction Documents: Testing Agency shall review the construction documents and note any variation from code requirements and provide a written report of their review and recommendations prior to any installation of piping or components.

C. Tests and Inspections:

1. Medical Compressed-Air Testing Coordination: Perform tests, inspections, verifications, and certification of medical compressed-air piping systems concurrently with tests,

inspections, and certification of medical gas piping and medical vacuum piping systems.

2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:

   a. Initial blowdown.
   b. Initial pressure test.
   c. Cross-connection test.
   d. Piping purge test.
   e. Standing pressure test for positive-pressure medical compressed-air piping.
   f. Repair leaks and retest until no leaks exist.

3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:

   a. Standing pressure test.
   b. Individual-pressurization or pressure-differential cross-connection test.
   c. Valve test.
   d. Master and area alarm tests.
   e. Piping purge test.
   f. Piping particulate test.
   g. Piping purity test.
   h. Final tie-in test.
   i. Operational pressure test.
   j. Medical air purity test.
   k. Verify correct labeling of equipment and components.

4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

   a. Inspections performed.
   b. Procedures, materials, and gases used.
   c. Test methods used.
   d. Results of tests.

D. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.9 PROTECTION

A. Protect tubing from damage.

B. Retain sealing plugs in tubing, fittings, and specialties until installation.

C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.10 PIPING SCHEDULE

A. Connect new tubing to existing tubing with memory-metal couplings.

B. Flanges may be used where connection to flanged equipment is required.

C. Medical Air Piping and Instrument Air Piping: Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.

3.11 VALVE SCHEDULE

A. Shutoff Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.

B. Zone Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

END OF SECTION 226113

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 226213

VACUUM PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Medical-surgical vacuum piping, designated "medical vacuum."
2. Waste anesthetic gas disposal piping, designated "WAGD."

B. Related Requirements:

1. Section 115313 "Laboratory Fume Hoods" for vacuum inlets in laboratory fume hoods.
2. Section 123553 "Laboratory Casework" for vacuum inlets in laboratory casework.
3. Section 123570 "Healthcare Casework" for vacuum inlets in healthcare casework.
4. Section 226219 "Vacuum Equipment for Laboratory and Healthcare Facilities" for vacuum producers and accessories.
5. Section 226400 "Medical Gas Alarms" for vacuum piping alarms.

1.3 DEFINITIONS

A. WAGD: Waste anesthetic gas disposal.

B. Medical vacuum piping systems include medical vacuum, WAGD, dental vacuum, HVE, and medical laboratory vacuum piping systems.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Review reports for testing agency’s review of construction documents.

C. Material Certificates: Signed by Installer certifying that medical vacuum piping materials comply with requirements in NFPA 99.

D. Brazing certificates.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For vacuum piping specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quick-Coupler Service Connections: Furnish complete noninterchangeable medical vacuum suction inlets.

a. Medical Vacuum: Equal to 10 percent of amount installed, but no fewer than 10 units.
b. WAGD: Equal to 10 percent of amount installed, but no fewer than 10 units.

2. D.I.S.S. Service Connections: Furnish complete medical vacuum suction inlets complying with CGA V-5.

a. Medical Vacuum D.I.S.S. No. 1220: Equal to 10 percent of amount installed, but no fewer than 10 units.
b. WAGD D.I.S.S. No. 2220: Equal to 10 percent of amount installed, but no fewer than 10 units.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Medical Vacuum Piping Systems for Healthcare Facilities: According to ASSE Standard #6010 for medical-gas-system installers.
2. Shape-Memory-Metal Coupling Joints: An authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.

C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Medical vacuum operating at 15 in. Hg.

B. WAGD operating at 15 in. Hg.

2.2 PIPES, TUBES, AND FITTINGS

A. Comply with NFPA 99 for medical vacuum piping materials.

B. Copper Medical Gas Tube: ASTM B 819, Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in blue.

C. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service.

D. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.

E. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.

1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, full-face type.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.

F. Shape-Memory-Metal Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

a. Aerofit, Inc.
b. Smart Tap, Inc.

3. Description: Cryogenic compression fitting made of nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.

G. Flexible Pipe Connectors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, product by one of the following:

a. Flex-Hose Co., Inc.
b. Flexicraft Industries.

c. Hyspan Precision Products, Inc.
d. Mercer Gasket & Shim, Inc.
e. Metraflex Company (The).
f. Proco Products, Inc.
g. Unaflex.
h. Universal Metal Hose; a Hyspan Co.

3. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

a. Working-Pressure Rating: 200 psig minimum.
b. End Connections: Plain-end copper tube.

2.3 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.

C. Threaded-Joint Tape: PTFE.

2.4 VALVES

A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.

1. Exception: Factory cleaning and bagging are not required for valves for WAGD service.

B. Zone-Valve Box Assemblies: Box with medical gas valves, tube extensions, and gages.

1. Zone-Valve Boxes:

a. Steel Box with Aluminum Cover:

1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2) Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

a) Allied Healthcare Products Inc.
b) Amico Corporation.
c) BeaconMedaes
d) Ohio Medical Corporation.
e) Patton’s Medical
f) Powerex.

b. Description: Formed steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation

of valves. Medical air and medical vacuum tubing, valves, and gages may be incorporated in zone valve boxes for medical gases.

1) Interior Finish: Factory-applied white enamel.
2) Cover Plate: Aluminum with frangible or removable windows.
3) Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

C. Copper-Alloy Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

   a. Allied Healthcare Products Inc.; Chemetron Division.
   b. Amico Corporation.
   c. BeaconMedaes.
   d. Conbraco Industries, Inc.
   e. Marwin Valve; a division of Richards Industries.
   f. NIBCO INC.
   g. Ohio Medical Corporation.
   h. Patton's Medical.
   i. Powerex.
   j. Tri-Tech Medical Inc.

3. Standard: MSS SP-110.
4. Description: Three-piece body, brass or bronze.
5. Pressure Rating: 300 psig minimum.
6. Ball: Full-port, chrome-plated brass.
7. Seats: PTFE or TFE.
8. Handle: Lever type with locking device.
9. Stem: Blowout proof with PTFE or TFE seal.
10. Ends: manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

D. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

   a. Allied Healthcare Products Inc.; Chemetron Division.
   b. Amico Corporation.
   c. BeaconMedaes.
   d. Conbraco Industries, Inc.
   e. Ohio Medical Corporation.
   f. Patton's Medical.
   g. Powerex.
   h. Tri-Tech Medical Inc.

3. Description: In-line pattern, bronze.
4. Pressure Rating: 300 psig minimum.
5. Operation: Spring loaded.
6. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

2.5 MEDICAL VACUUM SERVICE CONNECTIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Chemetron compatible product by one of the following:

1. Allied Healthcare Products Inc.; Chemetron Division.
2. Amico Corporation.
3. BeaconMedaes.
4. Ohio Medical Corporation.
5. Oxequip Health Industries; a division of Allied Healthcare Products Inc.
6. Patton's Medical.
7. Powerex.
8. Tri-Tech Medical Inc.

C. General Requirements for Medical Vacuum Service Connections:

1. Suitable for specific medical vacuum service listed.
2. Include roughing-in assemblies, finishing assemblies, and cover plates.
3. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate.
4. Recessed-type units made for concealed piping unless otherwise indicated.

D. Roughing-in Assembly:

1. Steel outlet box for recessed mounting and concealed piping.
2. Brass-body inlet block.
3. Seals that will prevent vacuum leakage.
4. ASTM B 819, NPS 3/8 copper outlet tube brazed to valve with service marking and tube-end dust cap.

E. Finishing Assembly:

1. Brass housing with primary check valve.
2. Seals that will prevent vacuum leakage.
3. Cover plate with gas-service label.

F. Quick-Coupler Suction Service Connections:

1. Inlets for medical vacuum and WAGD with noninterchangeable keyed indexing to prevent interchange between services.
2. Constructed to permit one-handed connection and removal of equipment.
3. With positive-locking ring that retains equipment stem in valve during use.

G. D.I.S.S. Suction Service Connections:

1. Inlets complying with CGA V-5.
2. Threaded indexing to prevent interchange between services.
3. Constructed to permit one-handed connection and removal of equipment.
4. Medical Vacuum: CGA V-5, D.I.S.S. No. 1220.
5. WAGD: CGA V-5, D.I.S.S. No. 2220.

H. Vacuum Bottle Brackets: One piece, with pattern and finish matching corresponding service cover plate.

I. Cover Plates:

1. One piece.
2. Aluminum or stainless steel.
3. Permanent, color-coded, identifying label matching corresponding service.

2.6 NITROGEN

A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1.
2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.

   a. Scrub to ensure complete cleaning.
   b. Rinse with clean, hot water to remove cleaning solution.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of vacuum piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, vacuum producer sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Comply with NFPA 99 for installation of vacuum piping.

C. Install piping concealed from view and protected from physical contact by building occupants

unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.

F. Install piping adjacent to equipment and specialties to allow service and maintenance.

G. Install vacuum piping with 1 percent slope downward in direction of flow.

H. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than piping pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.

I. Install eccentric reducers, if available, where vacuum piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

J. Provide drain leg and drain trap at end of each main and branch and at low points.

K. Install thermometer and vacuum gage on inlet piping to each vacuum producer and on each receiver and separator. Comply with requirements in Section 220519 "Meters and Gages for Plumbing Piping."

L. Install piping to permit valve servicing.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and for branch connections. Extruded-tee branch outlets in copper tubing may be made where specified.

O. Install medical vacuum piping from medical vacuum service connections specified in this Section, to equipment specified in Section 226219 "Vacuum Equipment for Laboratory and Healthcare Facilities," and to equipment specified in other Sections requiring medical vacuum service.

P. Piping Restraint Installation: Install seismic restraints on vacuum piping. Seismic-restraint devices are specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

Q. Install medical vacuum service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.

R. Install medical vacuum bottle bracket adjacent to each wall-mounted medical vacuum service connection suction inlet.

S. Connect vacuum piping to vacuum producers and to equipment requiring vacuum service.

T. Install unions in copper vacuum tubing adjacent to each valve and at final connection to each machine, specialty, and piece of equipment.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 VALVE INSTALLATION

A. Install shutoff valve at each connection to and from vacuum equipment and specialties.

B. Install check valves to maintain correct direction of vacuum flow to vacuum-producing equipment.

C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.

D. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.

E. Install flexible pipe connectors in suction inlet piping to each vacuum producer.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Apply appropriate tape to external pipe threads.

E. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Do not use flux. Continuously purge joint with oil-free dry nitrogen during brazing.

F. Flanged Joints:

1. Copper Tubing: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
2. PVC Piping: Install PVC flange on PVC pipes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

G. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

C. Vertical Piping: MSS Type 8 or Type 42, clamps.

D. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
2. Longer Than 100 Feet: MSS Type 43, adjustable, roller hangers.

E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.

F. Base of Vertical Piping: MSS Type 52, spring hangers.

G. Support horizontal piping within 12 inches of each fitting and coupling.

H. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch- minimum rods.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4: 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
3. NPS 3/4: 84 inches with 3/8-inch rod.
4. NPS 1: 96 inches with 3/8-inch rod.
5. NPS 1-1/4: 108 inches with 3/8-inch rod.
6. NPS 1-1/2: 10 feet with 3/8-inch rod.
7. NPS 2: 11 feet with 3/8-inch rod.
8. NPS 2-1/2: 13 feet with 1/2-inch rod.
9. NPS 3: 14 feet with 1/2-inch rod.
10. NPS 3-1/2: 15 feet with 1/2-inch rod.
11. NPS 4: 16 feet with 1/2-inch rod.
12. NPS 6: 20 feet with 5/8-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

3.6 IDENTIFICATION

A. Install identifying labels and devices for laboratory vacuum piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Install identifying labels and devices for medical vacuum piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:

1. Medical Vacuum: Black letters on white background.
2. WAGD: White letters on violet background.

3.7 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL VACUUM PIPING

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections of medical vacuum piping systems in healthcare facilities and to prepare test and inspection reports.

B. Review of Construction Documents: Testing Agency shall review the construction documents and note any variation from code requirements and provide a written report of their review and recommendations prior to any installation of piping or components.

C. Tests and Inspections:

1. Medical Vacuum Testing Coordination: Perform tests, inspections, verifications, and certification of medical vacuum piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical gas piping systems.
2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:

   a. Initial blowdown.
   b. Initial pressure test.
   c. Cross-connection test.
   d. Piping purge test.
   e. Standing pressure test for vacuum systems.
   f. Repair leaks and retest until no leaks exist.

3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:

   a. Standing pressure test.
   b. Individual-pressurization or pressure-differential cross-connection test.
   c. Valve test.
   d. Master and area alarm tests.
   e. Piping purge test.
   f. Final tie-in test.
   g. Operational vacuum test.
   h. Verify correct labeling of equipment and components.

4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

   a. Inspections performed.
   b. Procedures, materials, and gases used.
   c. Test methods used.
   d. Results of tests.

D. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.8 FIELD QUALITY CONTROL FOR LABORATORY FACILITY NONMEDICAL VACUUM PIPING

A. Testing Agency: Engage qualified testing agency to perform field tests and inspections of vacuum

piping in nonmedical laboratory facilities and to prepare test and inspection reports.

B. Tests and Inspections:

1. Piping Leak Tests for Vacuum Piping: Test new and modified parts of existing piping. Cap and fill vacuum piping with oil-free, dry nitrogen. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.

a. Test Pressure for Copper Tubing: 100 psig.

2. Repair leaks and retest until no leaks exist.
3. Inspect filters for proper operation.

C. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.9 PROTECTION

A. Protect tubing from damage.

B. Retain sealing plugs in tubing, fittings, and specialties until installation.

C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.10 PIPING SCHEDULE

A. Connect new copper tubing to existing copper tubing with memory-metal couplings.

B. Flanges may be used where connection to flanged equipment is required.

C. Medical Vacuum Piping: Use copper medical gas tube, wrought-copper fittings, and brazed joints.

D. WAGD Piping: Use copper medical gas tube, wrought-copper fittings, and brazed joints.

3.11 VALVE SCHEDULE

A. Shutoff Valves:

1. Copper Tubing: Copper-alloy ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.

B. Zone Valves: Copper-alloy ball valve with manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

END OF SECTION 226213

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 226313

GAS PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Carbon dioxide piping, designated "medical carbon dioxide."
2. Nitrogen piping, designated "medical nitrogen."
3. Nitrous oxide piping, designated "medical nitrous oxide."
4. Oxygen piping, designated "medical oxygen."

B. Related Requirements:

1. Section 115313 "Laboratory Fume Hoods" for gas outlets in laboratory fume hoods.
2. Section 123553 "Laboratory Casework" for gas outlets in casework.
3. Section 123570 "Healthcare Casework" for gas outlets in medical casework.
4. Section 226400 "Medical Gas Alarms" for combined medical air, vacuum, and gas alarms.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. Medical gas piping systems include medical carbon dioxide, medical nitrogen, medical nitrous oxide, and medical oxygen for healthcare facility patient care.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Review reports for testing agency’s review of construction documents.

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Review reports for testing agency's review of construction documents.

C. Seismic Qualification Certificates: For gas manifolds and bulk gas storage tanks, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Material Certificates: Signed by Installer certifying that medical gas piping materials comply with requirements in NFPA 99 for positive-pressure medical gas systems.

E. Brazing certificates.

F. Certificates of Shop Inspection and Data Report for Bulk Gas Storage Tanks: As required by ASME Boiler and Pressure Vessel Code.

G. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For medical and specialty gas piping specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quick-Coupler Service Connections: Furnish complete noninterchangeable medical gas pressure outlets and suction inlets.

a. Medical Carbon Dioxide: Equal to 10 percent of quantity installed, but no fewer than 10 units.
b. Medical Nitrous Oxide: Equal to 10 percent of quantity installed, but no fewer than 10 units.
c. Medical Oxygen: Equal to 10 percent of quantity installed, but no fewer than 10 units.
d. Medical Air: Equal to 10 percent of quantity installed, but no fewer than 10 units.
e. Instrument Air: Equal to 10 percent of quantity installed, but no fewer than 10 units.
f. Medical Vacuum: Equal to 10 percent of quantity installed, but no fewer than 10 units.
g. WAGD: Equal to 10 percent of quantity installed, but no fewer than 10 units.

2. D.I.S.S. Service Connections: Furnish complete medical gas pressure outlets and suction inlets complying with CGA V-5.

a. Medical Carbon Dioxide D.I.S.S. No. 1080: Equal to 10 percent of quantity installed, but no fewer than 10 units.
b. Medical Nitrogen D.I.S.S. No. 1120: Equal to 10 percent of quantity installed, but no fewer than 10 units.
c. Medical Nitrous Oxide D.I.S.S. No. 1040: Equal to 10 percent of quantity installed, but no fewer than 10 units.
d. Medical Oxygen D.I.S.S. No. 1240: Equal to 10 percent of quantity installed, but no fewer than 10 units.
e. Medical Air D.I.S.S. No. 1160: Equal to 10 percent of quantity installed, but no fewer than 10 units.
f. Instrument Air D.I.S.S. No. 1160: Equal to 10 percent of quantity installed, but no fewer than 10 units.
g. Medical Vacuum D.I.S.S. No. 1220: Equal to 10 percent of quantity installed, but no fewer than 10 units.
h. WAGD D.I.S.S. No. 2220: Equal to 10 percent of quantity installed, but no fewer than 10 units.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Medical Gas Piping Systems for Healthcare Facilities: According to ASSE Standard #6010 for medical-gas-system installers.
2. Bulk Medical Gas Systems for Healthcare Facilities: According to ASSE Standard #6015 for bulk-medical-gas-system installers.
3. Shape-Memory-Metal Coupling Joints: An authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the medical gas piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.

C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Medical carbon dioxide operating at 50 to 55 psig.

B. Medical helium operating at 50 to 55 psig.

C. Medical nitrogen operating at 160 to 185 psig.

D. Medical nitrous oxide operating at 50 to 55 psig.

E. Medical oxygen operating at 50 to 55 psig.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Medical gas manifolds shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the medical gas manifolds will remain in place without separation of any parts when subjected to the seismic forces specified and the manifolds and tanks will be fully operational after the seismic event."
2. Component Importance Factor is 1.5.

2.3 PIPES, TUBES, AND FITTINGS

A. Comply with NFPA 99 for medical gas piping materials.

B. Copper Medical Gas Tube: ASTM B 819, Type K and Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service; or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.

C. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type that has been manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.

D. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.

E. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.

1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch - maximum thickness, full-face type.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.

F. Flexible Corrugated Medical Tubing:

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:

   a. OmegaFlex , Meditrac.

2. Description: Corrugated copper alloy tubing system consisting of corrugated copper allot tubing with axially swaged brass fittings equipped with a stainless steel anti-tamper sleeve and copper tube stub; 185 PSIG maximum continuous operating pressure; 250º F maximum continuous operating temperature.

a. Corrugated medical tubing material conforming to ASTM B103, copper alloy C51000 complying with the requirements of NFPA 99-2018. Cleaning conforming to CGA G4.1.
b. Low density FR polyethylene, plenum rated jacket.
c. Metallic, yellow brass fittings copper alloy No. CA360 or equivalent complying with NFPA 99-2018. Cleaning conforming to CGA G4.1

G. Shape-Memory-Metal Couplings:

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:

a. Aerofit, Inc.
b. Smart Tap, Inc.

2. Description: Cryogenic compression fitting made of nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.

2.4 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.

B. Threaded-Joint Tape: PTFE.

C. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.

2.5 VALVES

A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.

B. Zone-Valve Box Assemblies: Box with medical gas valves, tube extensions, and gages.

1. Zone-Valve Boxes:

a. Steel Box with Aluminum Cover:

1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a) Allied Healthcare Products Inc.
b) Amico Corporation.
c) Ohio Medical Corporation.
d) Patton’s Medical.
e) Powerex Inc.

b. Description: Formed steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or

multiple valves with pressure gages and in sizes required to permit manual operation of valves. Medical air and medical vacuum tubing, valves, and gages may be incorporated in zone valve boxes for medical gases.

1) Interior Finish: Factory-applied white enamel.
2) Cover Plate: Aluminum with frangible or removable windows.
3) Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allied Healthcare Products Inc.; Chemetron Division.
   b. Amico Corporation.
   c. BeaconMedaes.
   d. Conbraco Industries, Inc.
   e. Marwin Valve; a division of Richards Industries.
   f. NIBCO INC.
   g. Ohio Medical Corporation.
   h. Patton's medical.
   i. Powerex Inc.

2. Standard: MSS SP-110.
3. Description: Three-piece body, brass or bronze.
4. Pressure Rating: 300 psig minimum.
5. Ball: Full-port, chrome-plated brass.
6. Seats: PTFE or TFE.
7. Handle: Lever[type with locking device].
8. Stem: Blowout proof with PTFE or TFE seal.
   Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

D. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allied Healthcare Products Inc.; Chemetron Division.
   b. Amico Corporation.
   c. BeaconMedaes.
   d. Conbraco Industries, Inc.
   e. Ohio Medical Corporation.
   f. Patton's Medical.
   g. Powerex Inc.

2. Description: In-line pattern, bronze.
3. Pressure Rating: 300 psig minimum.
4. Operation: Spring loaded.
5. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

E. Emergency Oxygen Connections: Low-pressure oxygen inlet assembly for connection to building oxygen piping systems.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Healthcare Products Inc.; Chemetron Division.
b. Amico Corporation.
c. BeaconMedaes.
d. Ohio Medical Corporation.
e. Patton's Medical.
f. Powerex Inc.

2. Enclosure: Weatherproof hinged locking cover with caption similar to "Emergency Low-Pressure Gaseous Oxygen Inlet."
3. Inlet: Manufacturer-installed, NPS 1 or NPS 1-1/4, ASTM B 819, copper tubing with NPS 1 minimum ball valve.
4. Safety Valve: Bronze-body pressure relief valve set at 75 or 80 psig.
5. Instrumentation: Pressure gage.

F. Safety Valves:

1. Bronze body.
2. ASME-construction, poppet, pressure-relief type.
3. Settings to match system requirements.

G. Pressure Regulators:

1. Bronze body and trim.
2. Spring-loaded, diaphragm-operated, relieving type.
3. Manual pressure-setting adjustment.
4. Rated for 250-psig minimum inlet pressure.
5. Capable of controlling delivered gas pressure within 0.5 psig for each 10-psig inlet pressure.

2.6 MEDICAL GAS SERVICE CONNECTIONS

A. Manufacturers: Subject to compliance with requirements provide products by one of the following:

1. Allied Healthcare Products Inc.; Chemetron Division.
2. Amico Corporation.
3. BeaconMedaes.
4. Ohio Medical Corporation.
5. Oxequip Health Industries; a division of Allied Healthcare Products Inc.
6. Patten's Medical.
7. Powerex Inc.

B. General Requirements for Medical Gas Service Connections:

1. Suitable for specific medical gas pressure and suction service listed.

2. Include roughing-in assemblies, finishing assemblies, and cover plates.
3. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate.
4. Recessed-type units made for concealed piping unless otherwise indicated.

C. Roughing-in Assembly:

1. Steel outlet box for recessed mounting and concealed piping.
2. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed. Suction inlets to be without secondary valve.
3. Double seals that will prevent gas leakage.
4. ASTM B 819, NPS 3/8 copper outlet tube brazed to valve with service marking and tube-end dust cap.

D. Finishing Assembly:

1. Brass housing with primary check valve.
2. Double seals that will prevent gas leakage.
3. Cover plate with gas-service label.

E. Quick-Coupler Pressure Service Connections: Outlets for carbon dioxide nitrous oxide and oxygen with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.

F. Quick-Coupler Pressure Service Connections: Outlets for instrument air with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.

G. Quick-Coupler Suction Service Connections: Inlets for medical vacuum with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.

H. D.I.S.S. Pressure Service Connections: Outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.

1. Medical Carbon Dioxide: D.I.S.S. No. 1080.
2. Medical Nitrogen: D.I.S.S. No. 1120.
3. Medical Nitrous Oxide: D.I.S.S. No. 1040.
4. Medical Oxygen: D.I.S.S. No. 1240.

I. D.I.S.S. Pressure Service Connections: Outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.

1. Medical Air: D.I.S.S. No. 1160.
2. Instrument Air: D.I.S.S. No. 1160.

J. D.I.S.S. Suction Service Connections: Inlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.

1. Medical Vacuum: D.I.S.S. No. 1220.
2. WAGD: D.I.S.S. No. 2220.

K. Cover Plates: One piece, aluminum or stainless steel and permanent, color-coded, identifying label matching corresponding service.

2.7 MEDICAL NITROGEN PRESSURE CONTROL PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Healthcare Products Inc.; Chemetron Division.
2. Amico Corporation.
3. BeaconMedaes.
4. Ohio Medical Corporation.
5. Patton's Medical.
6. Powerex Inc.

B. Description:

1. Steel box and support brackets for recessed roughing-in with stainless-steel or anodized-aluminum cover plate with printed operating instructions.
2. Manifold assembly consisting of inlet supply valve, inlet supply pressure gage, line-pressure control regulator, outlet supply pressure gage, D.I.S.S. service connection, and piping outlet for remote service connection.
3. Minimum Working Pressure: 200 psig.
4. Line-Pressure Control Regulator: Self-relieving diaphragm type with precision manual adjustment.
5. Pressure Gages: 0 to 300 psig.
6. Service Connection: CGA V-5, D.I.S.S. No. 1120, nitrogen outlet.
7. Before final assembly, provide temporary dust shield and U-tube for testing.
8. Label cover plate "Nitrogen Pressure Control."

2.8 MEDICAL GAS MANIFOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Cryogenics.
2. Allied Healthcare Products Inc.; Chemetron Division.
3. Amico Corporation.
4. BeaconMedaes.
5. Ohio Medical Corporation.
6. Patton's Medical.
7. Powerex Inc.

B. Comply with NFPA 99 for high-pressure medical gas cylinders.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Central Control-Panel Unit:

1. Supply and delivery pressure gages.
2. Electrical alarm-system connections and transformer.
3. Indicator lights or devices.
4. Manifold connection.
5. Pressure changeover switch.
6. Line-pressure regulator.
7. Shutoff valves.
8. Safety valve.

E. Manifold and Headers:

1. Duplex, nonferrous-metal header for number of cylinders indicated, divided into two equal banks.
2. Designed for 2000-psig minimum inlet pressure except nitrous oxide manifolds may be designed for 800 psig and carbon dioxide manifolds may be designed for 1500 psig.
3. Cylinder-bank headers with inlet (pigtail) connections complying with CGA V-1.
4. Individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.

F. Operation: Automatic, pressure-switch-activated changeover from one cylinder bank to the other when first bank becomes exhausted, without line-pressure fluctuation or resetting of regulators and without supply interruption by shutoff of either cylinder-bank header.

G. Mounting: Wall with mounting brackets for manifold control cabinet and headers.

H. Label manifold control unit with permanent label identifying medical gas type and system operating pressure.

2.9 GAS CYLINDER STORAGE RACKS

A. Wall Storage Racks: Fabricate racks with chain restraints for upright cylinders as indicated or provide equivalent manufactured wall racks.

B. Freestanding Storage Racks: Fabricate racks as indicated or provide equivalent manufactured storage racks.

2.10 NITROGEN

A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1.
2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.

    a. Scrub to ensure complete cleaning.
    b. Rinse with clean, hot water to remove cleaning solution.

3.2 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling and for underground warning tapes.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Comply with NFPA 99 for installation of medical gas piping.

C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.

F. Install piping adjacent to equipment and specialties to allow service and maintenance.

G. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.

H. Install piping to permit valve servicing.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and for branch connections.

K. Install medical gas piping to medical gas service connections specified in this Section, to medical gas service connections in equipment specified in this Section, and to equipment specified in other Sections requiring medical gas service.

L. Install exterior, buried medical gas piping in protective conduit fabricated with polyethylene pipe and fused fittings. Do not extend conduit through foundation wall. Corrugated medical tubing is acceptable for exterior buried piping.

M. Piping Restraint Installation: Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

N. Install medical gas service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.

O. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.

P. Install unions in copper tubing adjacent to each valve and at final connection to each specialty and piece of equipment.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.4 VALVE INSTALLATION

A. Install shutoff valve at each connection to gas laboratory and healthcare equipment and specialties.

B. Install check valves to maintain correct direction of gas flow from laboratory and healthcare gas supplies.

C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.

D. Install zone valves and gages in valve boxes. Arrange valves so largest valve is lowest. Rotate valves to angle that prevents closure of cover when valve is in closed position.

E. Install pressure regulators on gas piping where reduced pressure is required.

F. Install emergency oxygen connection with pressure relief valve and full-size discharge piping to outside, with check valve downstream from pressure relief valve, and with ball valve and check valve in supply main from bulk oxygen storage tank.

3.5 JOINT CONSTRUCTION

A. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.

B. Threaded Joints: Apply appropriate tape to external pipe threads.

C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Continuously purge joint with oil-free, dry nitrogen during brazing.

D. Axially swaged brass fittings. Install per manufacturers requirements.

E. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

3.6 GAS SERVICE COMPONENT INSTALLATION

A. Assemble patient-service console with service connections. Install with supplies concealed in walls. Attach console box or mounting bracket to substrate.

B. Install nitrogen pressure-control panels in walls. Attach to substrate.

C. Install gas manifolds anchored to substrate.

D. Install gas cylinders and connect to manifold piping.

E. Install gas manifolds with seismic restraints.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

C. Vertical Piping: MSS Type 8 or Type 42, clamps.

D. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
2. Longer Than 100 Feet: MSS Type 43, adjustable, roller hangers.

E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.

F. Base of Vertical Piping: MSS Type 52, spring hangers.

G. Support horizontal piping within 12 inches of each fitting and coupling.

H. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch- minimum rods.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4: 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
3. NPS 3/4: 84 inches with 3/8-inch rod.
4. NPS 1: 96 inches with 3/8-inch rod.
5. NPS 1-1/4: 108 inches with 3/8-inch rod.
6. NPS 1-1/2: 10 feet with 3/8-inch rod.
7. NPS 2: 11 feet with 3/8-inch rod.
8. NPS 2-1/2: 13 feet with 1/2-inch rod.
9. NPS 3: 14 feet with 1/2-inch rod.
10. NPS 3-1/2: 15 feet with 1/2-inch rod.
11. NPS 4: 16 feet with 1/2-inch rod.
12. NPS 6: 20 feet with 5/8-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

3.8 IDENTIFICATION

A. Install identifying labels and devices for specialty gas piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Install identifying labels and devices for healthcare medical gas piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:

1. Carbon Dioxide: Black or white letters on gray background.
2. Nitrogen: White letters on black background.
3. Nitrous Oxide: White letters on blue background.
4. Oxygen: White letters on green background or green letters on white background.

3.9 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL GAS

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Review of Construction Documents: Testing Agency shall review the construction documents and note any variation from code requirements and provide a written report of their review and recommendations prior to any installation of piping or components.

C. Tests and Inspections:

1. Medical Gas Piping Testing Coordination: Perform tests, inspections, verifications, and certification of medical gas piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical vacuum piping systems.
2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:

   a. Initial blowdown.
   b. Initial pressure test.

c. Cross-connection test.
d. Piping purge test.
e. Standing pressure test for positive-pressure medical gas piping.
f. Standing pressure test for vacuum systems.
g. Repair leaks and retest until no leaks exist.

3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:

a. Standing pressure test.
b. Individual-pressurization or pressure-differential cross-connection test.
c. Valve test.
d. Master and area alarm tests.
e. Piping purge test.
f. Piping particulate test.
g. Piping purity test.
h. Final tie-in test.
i. Operational pressure test.
j. Medical gas concentration test.
k. Medical air purity test.
l. Verify correct labeling of equipment and components.
m. Verify medical gas supply sources.

4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

a. Inspections performed.
b. Procedures, materials, and gases used.
c. Test methods used.
d. Results of tests.

D. Remove and replace components that do not pass tests and inspections and retest as specified above.

E. Prepare test and inspection reports.

3.10 FIELD QUALITY CONTROL FOR LABORATORY FACILITY SPECIALTY GAS

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Review of Construction Documents: Testing Agency shall review the construction documents and note any variation from code requirements and provide a written report of their review and recommendations prior to any installation of piping or components.

C. Tests and Inspections:

1. Piping Leak Tests for Specialty Gas Piping: Test new and modified parts of existing piping. Cap and fill specialty gas piping with oil-free, dry nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.

2. Repair leaks and retest until no leaks exist.
3. Inspect specialty gas regulators for proper operation.

D. Remove and replace components that do not pass tests and inspections and retest as specified above.

E. Prepare test and inspection reports.

3.11 PROTECTION

A. Protect tubing from damage.

B. Retain sealing plugs in tubing, fittings, and specialties until installation.

C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.12 DEMONSTRATION

A. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain bulk gas storage tanks.

3.13 VALVE SCHEDULE

A. Shutoff Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.

B. Zone Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

END OF SECTION 226313

SECTION 226710

PURE WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pure water piping.

1.3 DEFINITIONS

A. PP: Polypropylene plastic.

B. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping with the following minimum working-pressure ratings, unless otherwise indicated:

1. Deionized (Reagant grade) Water Piping: 150 psig unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For each type of pipe and fitting indicated.

B. Welding certificates.

C. Samples of field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing laboratory.

B. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

C. ASME Compliance: Comply with ASME B31.3, "Process Piping."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe and fittings from dirt and damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

B. Transition Fittings: Couplings, flanges, or other manufactured fittings, same size as, with pressure rating at least equal to and ends compatible with piping to be joined.

2.3 PLASTIC PIPE AND FITTINGS

A. Schedule 80, CPVC Pipe and Fittings: Ultra-pure piping and fittings are to be low extractable CPVC with a Cell classification of 12343 per ASTM D1784, Schedule 80 with a type II pressure rating. .

1. Manufacturers:

a. Spears LXT

2.4 PLASTIC VALVES

A. CPVC Valves: Made from ASTM D 1784, CPVC compounds.

1. Ball Valves, NPS 2 and Smaller: MSS SP-122, union type with socket ends and pressure rating not less than 150 psig at 73 deg F.
2. Check Valves: Swing or ball type with pressure rating not less than 150 psig at 73 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to and of material same as, or

compatible with, piping may be used in applications in this article, unless otherwise indicated.

B. Pure -Water Piping: Use the following piping materials for each size range:

1. Spears Schedule 80 LXT CPVC pipe and fittings and glued joints.
2. Piping running in the plenum shall be wrapped with an approved fire wrap to meet the fire and smoke requirements of the plenum.

3.2 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirement apply:

1. Shutoff Duty: Use ball valves.
2. Throttling Duty: Use ball valves.

B. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of deionized-water piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

C. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for general piping installation requirements.

3.3 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction. Where specific joint construction is not indicated, follow piping manufacturer's written instructions. Join in accordance with manufacturers recommendations.

B. Joint dissimilar pipe materials with transition fittings compatible with pipe materials being joined.

3.4 VALVE INSTALLATION

A. Refer to Division 23 Section "Valves" for general valve installation requirements.

B. Install sectional valves close to mains on each branch and riser serving equipment.

C. Install shutoff valve on each supply to equipment.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."

B. Pipe hanger and support devices and installation requirements are specified in Division 23 Section "Hangers and Supports." Install the following:

1. Clamps for Vertical Piping: MSS Type 8 or Type 42.
2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, to minimum of 3/8 inch.

F. Install padded hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 42 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches mm with 1/2-inch rod.
4. NPS 4 and NPS 5 and DN 125: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

G. Install padded supports for vertical PVC piping every 48 inches.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect deionized-water piping to equipment and service outlets with unions or flanges.

3.7 LABELING AND IDENTIFICATION

A. Install pipe markers and valve tags on piping. Distinguish between different systems and include direction of flow indication on each pipe. Labeling and identification devices are specified in Division 23 Section "Mechanical Identification."

3.8 FIELD QUALITY CONTROL

A. Test new piping and parts of existing piping that have been altered, extended, or repaired, for leaks and defects.

1. Schedule tests and their inspections by authorities having jurisdiction, with at least 24

hours' advance notice.

2. Do not cover or put into service before inspection and approval.
3. Test completed piping according to authorities having jurisdiction. If authorities having jurisdiction do not have published procedures, perform tests as follows:

    a. Hydrostatic Tests: Test piping at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.
    b. Exception: Do not subject glass piping to pressure above manufacturer's pressure rating for size.

4. Replace leaking joints with new materials and retest until no leaks exist.
5. Submit separate reports for each test.

3.9 CLEANING

A. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:

    1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
    2. Clean piping by flushing with system deionized water.

END OF SECTION 226710

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230100

MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The General Conditions of the Contract, with the amendments, supplements, forms and requirements in Division 1, and herewith made a part of this Division.

B. All sections of Division 21, 22, & 23 shall comply with the Mechanical General Requirements. The standards established in this section as to quality of materials and equipment, the type and quality of workmanship, mode of operations, safety rules, code requirements, etc., shall apply to all sections of this Division as though they were repeated in each Division.

C. Mechanical equipment that is pre-purchased if any will be assigned to the Mechanical Contractor. By assignment to the Mechanical Contractor, the Mechanical Contractor shall accept and installed the equipment and provide all warrantees and guarantees as if the Mechanical Contractor had purchased the equipment.

D. Construction Indoor-Air Quality Management

1. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."

   a. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
   b. Replace all air filters immediately prior to occupancy.

2. Comply with one of the following requirements:

   a. After Construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. Ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.

   b. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space.

1.2 SCOPE OF WORK

A. The project described herein is the Layton Ambulatory Surgery Center Operating Room Expansion. This work shall include all labor, materials, equipment, fixtures, and devices for the entire mechanical work and a complete operating and tested installation as required for this project.

B. This Division will schedule the boiler inspection and pay for all costs associated with certifying the boiler with the state.

1.3 CODES & ORDINANCES

A. All work shall be executed in accordance with all underwriters, public utilities, local and state rules and regulations applicable to the trade affected. Should any change in the plans and Specifications be required to comply with these regulations, the Contractor shall notify the Architect before the time of submitting his bid. After entering into contract, the Contractor will be held to complete all work necessary to meet these requirements without extra expense to the Owner. Where work required by drawings or specifications is above the standard required, it shall be done as shown or specified.

B. Applicable codes:

1. Utah Boiler and Pressure Vessel Rules and Regulations- Latest Edition
2. International Building Code- 2024 Edition
3. International Mechanical Code- 2024 Edition
4. International Plumbing Code- 2024 Edition
5. International Fire Code- 2024 Edition
6. International Energy Code- 2024 Edition
7. International Fuel Gas Code- 2024 Edition
8. Utah Electrical Code 2023 – NFPA 70,2023 Edition

1.4 INDUSTRY STANDARDS

A. All work shall comply with the following standards.

1. Associated Air Balance council (AABC)
2. Air Conditioning and Refrigeration Institute (ARI)
3. Air Diffusion council (ADC)
4. Air Movement and Control Association (AMCA)
5. American Gas Association (AGA)
6. American National Standards Institute (ANSI)
7. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
8. American Society of Mechanical Engineers (ASME)
9. American Society of Testing Materials (ASTM)
10. American Water Works Association (AWWA)
11. Cooling Tower Institute (CTI)
12. ETL Testing Laboratories (ETL)
13. Institute of Electrical and Electronic Engineers (IEEE)
14. Hydronics Institute (HI)
15. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)
16. National Fire Protection Association (NFPA)

17. National Electrical Code (NEC)
18. National Electrical Manufacturers Association (NEMA)
19. National Electrical Safety code (NESC)
20. Utah safety Standard (OSHA), Utah State Industrial Council.
21. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
22. Underwriters Laboratories (UL)
23. Tubular Exchanger Manufacturers Association, Inc. (TEMA)
24. Heat Exchanger Institute (HEI)
25. Hydraulic Institute (HI)
26. Thermal Insulation Manufacturer=s Association (TIMA)
27. Scientific Apparatus Makers Association (SAMA)

B. Compliance Verification:

1. All items required by code or specified to conform to the ASME code shall be stamped with the ASME seal.
2. Form U-1, the manufacturer=s data report for pressure vessels, is to be included in the Operation and Maintenance Manuals. National Board Register (NBR) numbers shall be provided where required by code.
3. Manufactured equipment which is represented by a UL classification and/or listing, shall bear the UL or equivalent ETL label.

1.5 UTILITIES & FEES

A. All fees for permits required by this work will be paid by this division with the understanding that any fees that are required to be paid will be reimbursed by the owner. The contractor shall obtain the necessary permits to perform this work. Unless noted otherwise, all systems furnished and or installed by this Contractor, shall be complete with all utilities, components, commodities and accessories required for a fully functioning system. This Contractor shall furnish smoke generators when required for testing, furnish glycol for glycol piping systems, full load of salt to fill brine tank for water softening system, furnish cleaners and water treatment additives.

1.6 SUBMITTALS AND SHOP DRAWINGS

A. General: As soon as possible after the contract is awarded, but in no case more than 45 calendar days thereafter, the Contractor shall submit to the Architect manufacturer's data on products and materials to be used in the installation of mechanical systems for this project. The review of the submitted data will require a minimum of 14 days. The first day starts after the day they are received in the engineer's office to which the project is being constructed from. If the Contractors schedule requires return of submitted literature in less than the allotted time, the Contractor shall accelerate his submittal delivery date. The Contractor shall resubmit all items requiring re-review within 14 days of returned submittals. Refer to each specification section for items requiring submittal review. If the re-submittal is returned a 2nd time for correction the Contractor will provide the specific equipment that is specified on the drawings and/or the specifications. Written approval of the Owner's Representative shall be obtained before installing any such equipment or materials for the project.

B. Review by the Owner's Representative is for general conformance of the submitted equipment to the project specification. In no way does such review relieve this Contractor of his obligation to furnish equipment and materials that comply in detail to the specification nor does it relieve the Contractor of his obligation to determine actual field dimensions and conditions that may affect

his work. Regardless of any items overlooked by the submittal review, the requirements of the contract drawings and specifications must be followed and are not waived or superseded in any way by the review.

C. By description, catalog number, and manufacturer's names, standards of quality have been established by the Architect and the Engineer for certain manufactured equipment items and specialties that are to be furnished by this Division. Alternate products and equipment may be proposed for use only if specifically named in the specifications or if given written prior approval in published addenda. Design equipment is the equipment listed on the drawings or if not listed on the drawings is the equipment first named in the specifications.

D. Submittal Format: At the contractor's discretion, project submittals may be in either of the formats described in the following paragraphs, but mixing the two formats is not acceptable.

1. Electronic Submittal Format: Identify and incorporate information in each electronic submittal file as follows:

a. All items shall be submitted at one time except automatic temperature control drawings and seismic restraint drawings which may be submitted separately within 120 days of the contract award date. Partial submittals will not be reviewed until the complete submittal is received.
b. Submitted electronic file shall bear the Contractor's stamp, indicating that he has checked all equipment being submitted; that each item will fit into the available space with the accesses shown on the drawings; and, further, that each item conforms to the capacity and quality standards given in the contract documents.
c. Submitted electronic file shall clearly indicate performance, quality, and utility requirements; shall show dimension and size of connection points; and shall include derating factors that were applied for each item of equipment to provide capacity at job site elevation. Temperature control submittals shall include piping and wiring diagrams, sequence of operation and equipment. Equipment must fit into the available space with allowance for operation, maintenance, etc. Factory piped and wired equipment shall include shop drawings for all internal wiring and piping furnished with the unit.
d. Submitted electronic file shall clearly show all required field install wiring, piping, and accessory installations required by the Contractor to provide a complete operating system.
e. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
f. Name file with submittal number or other unique identifier, including revision identifier.

g. Electronic file shall be completely electronically searchable or it will be rejected.

h. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by:

1) Architect.

i. Transmittal Form for Electronic Submittals:

1) Use one of the following options acceptable to the Owner;

a) Software-generated form from electronic project management software.
b) Electronic form.

2) The Electronic Submittal shall contain the following information:

a) Project name.
b) Date.
c) Name and address of Architect.
d) Name of Construction Manager.
e) Name of Contractor.
f) Name of firm or entity that prepared submittal.
g) Names of subcontractor, manufacturer, and supplier.
h) Category and type of submittal.
i) Submittal purpose and description.
j) Specification Section number and title.
k) Specification paragraph number or drawing designation and generic name for each of multiple items.
l) Drawing number and detail references, as appropriate.
m) Location(s) where product is to be installed, as appropriate.
n) Related physical samples submitted directly.
o) Indication of full or partial submittal.
p) Transmittal number[, numbered consecutively].
q) Submittal and transmittal distribution record.
r) Other necessary identification.
s) Remarks.

j. Metadata: Include the following information as keywords in the electronic submittal file metadata:

1) Project name.
2) Number and title of appropriate Specification Section.
3) Manufacturer name.
4) Product name.

E. Submittal Requirements - Submittals MUST be compiled in PDF format, organized, properly labeled with specification sections, and book marked.

1. Submittal files larger than 25MB must be delivered to the Mechanical Contractors office via thumb drive.
2. Subcontractor/Vendor markups should be purple. GC markups will be blue, architect markups will be red, and consultant markups will be green. Any variations of sizing and/or performance shall be clearly indicated with an explanation of variation.
3. Submittals must be submitted no later than two weeks from notice.
4. Partial submittals will not be accepted. All required test data, certifications, qualification data, schedules, shop drawings, test reports, etc. must be included.
5. Substitutions not previously accepted will not be allowed in submittals.
6. All clarifications and questions about scope of work must be submitted in RFI(s) rather than in submittals
7. Specific schedule of lead times for all items that are not ‘off the shelf’ must be submitted within 10 days of NTP. (See schedule requirements)

1.7 DRAWINGS AND MEASUREMENTS

A. Construction Drawings: The contract document drawings show the general design, arrangements, and extent of the system. In certain cases, the drawings may include details that show more nearly exact locations and arrangements; however, the locations, as shown diagrammatically, are to be regarded as general.

B. It shall be the work of this Section to make such slight alterations as may be necessary to make adjustable parts fit to fixed parts, leaving all complete and in proper shape when done. All dimensions given on the drawings shall be verified as related to this work and with the Architect's office before work is started.

C. This Section shall carefully study building sections, space, clearances, etc., and then provide offsets in piping or ductwork as required to accommodate the building structure without additional cost to the Owner. In any case and at any time during the construction process, a change in location required by obstacles or the installation of other trades not shown on the mechanical plans shall be made without charge.

D. The drawings shall not be scaled for roughing in measurements nor shall they be used as shop drawings. Where drawings are required for these purposes or where drawings must be made from field measurements, the Contractor shall take the necessary measurements and prepare the drawings. Shop drawings of the various subcontractors shall be coordinated to eliminate all interferences and to provide sufficient space for the installation of all equipment, piping, ductwork, etc.

E. The drawings and specifications have been prepared to supplement each other and they shall be interpreted as an integral unit with items shown on one and not the other being furnished and installed as though shown and called out on both.

F. Coordination Drawings: The contractor shall provide coordination drawings for mechanical rooms, fan rooms, equipment rooms, and congested areas to eliminate conflicts with equipment, piping, or work of other trades. The drawings shall be a minimum scale of 1/4 inch= 1 foot and of such detail as may be required by the Engineer to fully illustrate the work. These drawings shall include all piping, conduit, valves, equipment, and ductwork.

G. Sheet-metal shop drawings will be required for all ductwork in the entire building. These drawings will show all ductwork in the entire building and shall be coordinated with architectural, structural and electrical portions of the project. The contractor shall specifically obtain copies of the structural shop drawings and shall coordinate the ductwork shop drawings with approved structural members. These drawings shall be submitted to the engineer for review prior to any fabrication. The contractor is responsible for all modifications necessary to accommodate duct installation within the structural, architectural and electrical restrictions. These drawings, once reviewed by the engineer, will be made available to all mechanical, electrical, and fire sprinkler subcontractors to coordinate installation of their work.

1.8 CONTRACTOR'S USE OF BUILDING EQUIPMENT

A. The Contractor may use equipment such as electric motors, fans, heat exchangers, filters, etc., with the written permission of the Owner. As each piece of equipment is used (such as electric motors and fans), maintenance procedures approved by the manufacturer are to be followed. A careful record is to be kept of the length of the time the equipment is used, maintenance procedures followed, and any difficulty encountered. The record is to be submitted to the Owner

upon acceptance. All fan belts and filter media (such as bearings) shall be carefully inspected just prior to acceptance. Any excessive wear noted shall require replacement. New filter media shall be installed in air handlers at the time systems are turned over to the owner.

1.9 EXISTING CONDITIONS

A. The Contractor shall carefully examine all existing conditions that might affect the mechanical system and shall compare these conditions with all drawings and specifications for work included under this contract. He shall, at such time, ascertain and check all conditions that may affect his work. No allowance shall subsequently be made in his behalf for an extra expense incurred as a result of his failure or neglect to make such examination. This Contractor shall include in his bid proposal all necessary allowances to repair or replace any item that will remain or will be removed, and any item that will be damaged or destroyed by new construction.

B. The Contractor shall remove all abandoned piping, etc., required by new construction and cap or plug openings. No capping, etc., shall be exposed in occupied areas. All openings of items removed shall be sealed to match adjacent surfaces.

C. The Contractor shall verify the exact location of all existing services, utilities, piping, etc., and make connections to existing systems as required or as shown on the drawings. The exact location of each utility line, together with size and elevation, shall be established before any on-site lines are installed. Should elevation or size of existing main utility lines make connections to them impossible as shown on drawings, then notification of such shall immediately be given to the Owners Representative for a decision.

1.10 EQUIPMENT CAPACITIES

A. Capacities shown for equipment in the specifications and on the drawings are the minimum acceptable. No equipment shall be considered as an alternate that has capacities or performance less than that of design equipment.

B. All equipment shall give the specified capacity and performance at the job-site elevation. Manufacturers' standard ratings shall be adjusted accordingly. All capacities and performances listed on drawings or in specifications are for job-site conditions.

1.11 SEISMIC REQUIREMENTS FOR EQUIPMENT

A. All equipment shall be furnished structurally adequate to withstand seismic forces as outlined in the International Building Code. Refer to section Mechanical Vibration Controls and Seismic Restraints. Equipment bases shall be designed for direct attachment of seismic snubbers and/or seismic anchors.

1.12 COOPERATION WITH OTHER TRADES

A. The Contractor shall refer to other drawings and parts of this specification that cover work of other trades that is carried on in conjunction with the mechanical work such that all work can proceed without interference resulting from lack of coordination.

B. The Contractor shall properly size and locate all openings, chases, sleeves, equipment bases, and accesses. He shall provide accurate wiring diagrams to the Electrical Contractor for all

equipment furnished under this Division.

C. The ceiling cavity must be carefully reviewed and coordinated with all trades. In the event of conflict, the installation of the mechanical equipment and piping shall be in the following order: plumbing, waste, and soil lines; supply, return, and exhaust ductwork; water piping; medical gases; fire protection piping; and pneumatic control piping.

D. The mechanical Contractor shall insure that the installation of all piping, ducts and equipment is in compliance with Articles 110-16 and 384-4 of the National Electrical Code relative to proper clearances in front of and over all electrical panels and equipment. No piping or ductwork will be allowed to run over electrical panel.

1.13 RESPONSIBILITY OF CONTRACTOR

A. The Contractor is responsible for the installation of a satisfactory piece of work in accordance with the true intent of the drawings and specifications. He shall provide, as a part of his work and without expense, all incidental items required even though these items are not particularly specified or indicated. The installation shall be made so that its several component parts will function together as a workable system and shall be left with all equipment properly adjusted and in working order. The Contractor shall familiarize the Owner's Representative with maintenance and lubrication instructions as prepared by the Contractor and shall explain and fully instruct him relative to operating, servicing, and maintenance of them.

B. If a conflict arises between the drawings and the specifications the most stringent procedure/action shall be followed. A clarification to the engineer will help to determine the course of action to be taken. If a conflict arises between specification sections the engineer will determine which course of action is to be followed.

1.14 PIPE AND DUCT OPENINGS AND EQUIPMENT RECESSES

A. Pipe and duct chases, openings, and equipment recesses shall be provided by others only if shown on architectural or structural drawings. All openings for the mechanical work, except where plans and specifications indicate otherwise, shall be provided as work of this Division. Include openings information with coordination drawings.

B. Whether chases, recesses, and openings are provided as work of this Division or by others, this Contractor shall supervise their construction and be responsible for the correct size and location even though detailed and dimensioned on the drawings. This Contractor shall pay for all necessary cutting, repairing, and finishing if any are left out or incorrectly made. All necessary openings thru existing walls, ceilings, floors, roofs, etc. shall be provided by this Contractor unless indicated otherwise by the drawing and/or specifications.

1.15 UNFIT OR DAMAGED WORK

A. Any part of this installation that fails, is unfit, or becomes damaged during construction, shall be replaced or otherwise made good. The cost of such remedy shall be the responsibility of this Division.

1.16 WORKMANSHIP

A. Workmanship shall be the best quality of its kind for the respective industries, trades, crafts, and practices, and shall be acceptable in every respect to the Owner's representative. Nothing contained herein shall relieve the Contractor from making good and perfect work in all details in construction.

1.17 SAFETY REGULATION

A. The Contractor shall comply with all local, Federal, and OSHA safety requirements in performance with this work. (See General Conditions). This Contractor shall be required to provide equipment, supervision, construction, procedures, and all other necessary items to assure safety to life and property.

1.18 ELECTRICAL SERVICES

A. All equipment control wiring and all automatic temperature control wiring including all necessary contacts, relays, and interlocks, whether low or line voltage, except power wiring, shall be furnished and installed as work of this Division unless shown to be furnished by Division 26. All such wiring shall be in conduit as required by electrical codes. Wiring in the mechanical rooms, fans rooms and inaccessible ceilings and walls shall be installed in conduit as well. Installation of any and all wiring done under Division 21, 22 and 23 shall be in accordance with the requirements of Division 26, Electrical.

B. All equipment that requires an electrical connection shall be furnished so that it will operate properly and deliver full capacity on the electrical service available.

C. Refer to the electrical control equipment and wiring shown on the diagrams. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the Contractor furnishing the equipment.

D. The Mechanical Contractor must coordinate with the Electrical Contractor to insure that all required components of control work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of such coordination.

1.19 WORK, MATERIALS, AND QUALITY OF EQUIPMENT

A. Unless otherwise specified, all materials shall be new and of the best quality of their respective kinds and all labor shall be done in a most thorough and workmanlike manner.

B. Products or equipment of any of the manufacturers cited herein or any of the products approved by the Addenda may be used. However, where lists of products are cited herein, the one first listed in the design equipment used in drawings and schedules to establish size, quality, function, and capacity standards. If other than design equipment is used, it shall be carefully checked for access to equipment, electrical and control requirements, valving, and piping. Should changes or additions occur in piping, valving, electrical work, etc., or if the work of other Contractors would be revised by the alternate equipment, the cost of all changes shall be borne as work of this Division.

C. The Execution portions of the specifications specify what products and materials may be used. Any products listed in the Product section of the specification that are not listed in the Execution portion of the specification may not be used without written approval by the Engineer.

D. The access to equipment shown on the drawings is the minimum acceptable space requirements. No equipment that reduces or restricts accessibility to this or any other equipment will be considered.

E. All major items of equipment are specified in the equipment schedules on the drawings or in these specifications and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory installation.

F. All welders shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code, latest Edition.

1.20 PROTECTION AGAINST WEATHER AND STORING OF MATERIALS

A. All equipment and materials shall be properly stored and protected against moisture, dust, and wind. Coverings or other protection shall be used on all items that may be damaged or rusted or may have performance impaired by adverse weather or moisture conditions. Damage or defect developing before acceptance of the work shall be made good at the Contractor's expense.

B. All open duct and pipe openings shall be adequately covered at all times.

1.21 INSTALLATION CHECK

A. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment indicated in the equipment schedule and the seismic supplier shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the Engineer.

B. Each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and, (4) has been operated under full load conditions and that it operated satisfactorily.

C. All costs for this work shall be included in the prices quoted by equipment suppliers.

1.22 EQUIPMENT LUBRICATION

A. The Contractor shall properly lubricate all pieces of equipment before turning the building over to the Owner. A linen tag shall be attached to each piece of equipment, showing the date of lubrication and the lubricant used. No equipment shall be started until it is properly lubricated.

B. Necessary time shall be spent with the Owner's Representative to thoroughly familiarize him with all necessary lubrications and maintenance that will be required of him.

C. Detergent oil as used for automotive purposes shall not be used for this work.

1.23 CUTTING AND PATCHING

A. No cutting or drilling in structural members shall be done without written approval of the Architect. The work shall be carefully laid out in advance, and cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces necessary for the mechanical work shall be carefully done. Any damage to building, piping, or equipment shall be repaired by professional plasterers, masons, concrete workers, etc., and all such work shall be paid for as work of this Division.

B. When concrete, grading, etc., is disturbed, it shall be restored to original condition as described in the applicable Division of this Specification.

1.24 EXCAVATION AND BACKFILLING

A. All necessary excavations and backfilling for the Mechanical phase of this project shall be provided as work of this Division. Trenches for all underground pipelines shall be excavated to the required depths. The bottom of trenches shall be compacted hard and graded to obtain required fall. Backfill shall be placed in horizontal layers, not exceeding 12 inches in thickness, and properly moistened. Each layer shall be compacted, by suitable equipment, to a density of not less than 95 percent as determined by ASTM D-1557. After pipelines have been tested, inspected, and approved, the trench shall be backfilled with selected material. Excess earth shall be hauled from the job site. Fill materials approved by the Architect shall be provided as work of this Division.

B. No trenches shall be cut near or under any footings without consultation first with the Architect's office. Any trenches or excavations more than 30 inches deep shall be tapered, shored, covered, or otherwise made absolutely safe so that no vehicle or persons can be injured by falling into such excavations, or in any way be harmed by cave-ins, shifting earth, rolling rocks, or by drowning. This protection shall be extended to all persons approaching excavation related to this work whether or not such persons are authorized to be in the vicinity of the construction.

1.25 ACCESS

A. Provide access doors in walls, ceilings and floors by this division unless otherwise noted. For access to mechanical equipment such as valves, dampers, VAV boxes, fans, controls, etc. Refer to Division 8 for door specifications. All access doors shall be 24" x 24" unless otherwise indicated or required. Coordinate location of doors with the Architect prior to installation. . If doors are not specified in Division 8, provide the following: Doors in ceilings and wall shall be equal to JR Smith No. 4760 bonderized and painted. Doors in tile walls shall be equal to JR Smith No. 4730 chrome plated. Doors in floors shall be equal to JR Smith No. 4910

B. Valves: Valve must be installed in locations where access is readily available. If access is compromised, as judged by the Mechanical Engineer, these valves shall be relocated where directed at the Contractors expense.

C. Equipment: Equipment must be installed in locations and orientations so that access to all components requiring service or maintenance will not be compromised. If access is compromised, as judged by the Mechanical Engineer, the contractor shall modify the installation as directed by the Engineer at the Contractors expense.

D. It is the responsibility of this division to install terminal boxes, valves and all other equipment and devices so they can be accessed. If any equipment or devices are installed so they cannot be accessed on a ladder a catwalk and ladder system shall be installed above the ceiling to access

and service this equipment.

1.26 CONCRETE BASES AND INSERTS

A. Bases: The concrete bases shall be provided and installed as work by this divsion. This Division shall be responsible for the proper size and location of bases and shall furnish all required anchor bolts and sleeves with templates to be installed as work of Division 3, Concrete.

B. All floor-mounted mechanical equipment shall be set on 6-inch high concrete bases, unless otherwise noted or shown on drawings. Such bases shall extend 6 inches beyond equipment or mounting rails on all sides or as shown on the drawings and shall have a 1-inch beveled edge all around.

C. Inserts: Where slotted or other types of inserts required for this work are to be cast into concrete, they shall be furnished as work of this Division

D. Concrete inserts and pipe support systems shall be equal to Unistrut P3200 series for all piping where more than one pipe is suspended at a common location. Spacing of the inserts shall match the size and type of pipe and of ductwork being supported. The Unistrut insert and pipe support system shall include all inserts, vertical supports, horizontal support members, clamps, hangers, rollers, bolts, nuts, and any other accessory items for a complete pipe-supporting system.

1.27 CLEANING AND PAINTING

A. Cleaning: After all tests and adjustments have been made and all systems pronounced satisfactory for permanent operation, this Contractor shall clean all exposed piping, ductwork, insulated members, fixture, and equipment installed under this Section and leave them ready for painting. He shall refinish any damaged finish and leave everything in proper working order. The Contractor shall remove all stains or grease marks on walls, floors, glass, hardware, fixtures, or elsewhere, caused by his workman or for which he is responsible. He shall remove all stickers on plumbing fixtures, do all required patching up and repair all work of others damaged by this division of the work, and leave the premises in a clean and orderly condition.

B. Painting: Painting of exposed pipe, insulated pipe, ducts, or equipment is work of Division 9, Painting.

C. Mechanical Contractor: All equipment which is to be furnished in factory prefinished conditions by the mechanical Contractor shall be left without mark, scratch, or impairment to finish upon completion of job. Any necessary refinishing to match original shall be done. Do not paint over nameplates, serial numbers, or other identifying marks.

D. Removal of Debris, Etc: Upon completion of this division of the work, remove all surplus material and rubbish resulting from this work, and leave the premises in a clean and orderly condition.

1.28 CONTRACT COMPLETION

A. Maintenance Instructions: The Contractor shall furnish the Owner complete printed and illustrated operating and maintenance instructions covering all units of mechanical equipment, together with parts lists.

B. Instructions To Owner's Representatives: In addition to any detailed instructions called for, the mechanical Contractor must provide, without expense to the Owner, competent instructors to train the Owner's representatives who will be in charge of the apparatus and equipment, in the care, adjustment, and operation of all parts on the heating, air conditioning, ventilating, plumbing, fire protection, and automatic temperature control equipment. Instruction dates shall be scheduled at time of final inspection. A written report specifying times, dates, and name of personnel instructed shall be forwarded to the Architect. A minimum of four 8-hour instruction periods shall be provided. The instruction periods will be broken down to shorter periods when requested by the Owner. The total instruction hours shall not reduced. The ATC Contractor shall provide 4 hours of instructions. The remaining hours shall be divided between the mechanical and sheet metal Contractor.

C. Guarantee: By the acceptance of any contract award for the work herein described or shown on the drawings, the Contractor assumes the full responsibility imposed by the guarantee as set forth herein and in the General Conditions, and should protect himself through proper guarantees from equipment and special equipment Contractors and from subcontractors as their interests may appear.

D. The guarantee so assumed by the Contractor and as work of this Section is as follows:

1. That the entire mechanical system, including plumbing, heating, and air-conditioning system shall be quiet in operation.
2. That the circulation of water shall be complete and even.
3. That all pipes, conduit, and connections shall be perfectly free from foreign matter and pockets and that all other obstructions to the free passage of air, water, liquid, sewage, and vent shall be removed.
4. That he shall make promptly and free of charge, upon notice from the Owner, any necessary repairs due to defective workmanship or materials that may occur during a period of one year from date of Substantial Completion.
5. That all specialties, mechanical, and patent devices incorporated in these systems shall be adjusted in a manner that each shall develop its maximum efficiency in the operation of the system; i.e., diffusers shall deliver the designed amount of air shown on drawings, thermostats shall operate to the specified limits, etc.
6. All equipment and the complete mechanical, ductwork, piping and plumbing systems shall be guaranteed for a period of one year from the date of the Architect's Certificate of Substantial Completion, this includes all mechanical, ductwork, piping and plumbing equipment and products and is not limited to boiler, chillers, coils, fans, filters etc. Any equipment supplier not willing to comply with this guarantee period shall not submit a bid price for this project. The Contractor shall be responsible for a 100-percent guarantee for the system and all items of equipment for this period. If the contractor needs to provide temporary heating or cooling to the building and or needs to insure systems are installed properly and or to meet the project schedule the guaranteed of all systems and equipment shall be as indicated above, on year from the date of the Architect’s Certificate of Substantial Completion.
7. All filters used during construction shall be replaced just before equipment is turned over to the Owner, and all required equipment and parts shall be oiled. Any worn parts shall also be replaced.
8. If any systems or equipment is used for temporary heating or cooling the systems shall be protected so they remain clean. I.e. if the ductwork systems are used temporary filters and a filter holder (not duct-taped to ducts or grilles) shall be installed to insure the systems and the equipment remain clean.

1.29 CURBS

A. Unless otherwise noted in these specifications or on the documents all roof curbs for all equipment are to be provided by Division 22 and 23.

1.30 TEST RUN

A. The Mechanical Contractor shall operate the mechanical system for a minimum of 30 days to prove the operation of the system.

1.31 EQUIPMENT STARTUP AND CHECKOUT:

A. Each major piece of equipment shall be started and checked out by an authorized representative of the equipment manufacturer. A certificate indicating the equipment is operating to the satisfaction of the manufacturer shall be provided and shall be included in the commissioning report.

B. This contractor shall coordinate commissioning procedures and activities with the commissioning agent.

1.32 DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

B. Proceed with demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

C. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

D. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

E. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

F. Maintain adequate ventilation when using cutting torches.

G. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

H. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

I. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

J. Dispose of demolished items and materials promptly.

K. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

L. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

M. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

N. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

O. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

P. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

END OF SECTION 230100

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.
12. Link-Seal

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, and crawlspaces.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces, mechanical equipment rooms, accessible pipe shafts, accessible plumbing chases, and accessible tunnels.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.

2.5 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Watts Industries, Inc.; Water Products Div

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated and rough brass.

D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

E. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.10 LINK-SEAL MODULAR SEAL PRESSURE PLATES

A. Link-Seal® modular seal pressure plates shall be molded of glass reinforced Nylon Polymer with the following properties:

1. Izod Impact - Notched = 2.05ft-lb/in. per ASTM D-256
2. Flexural Strength @ Yield = 30,750 psi per ASTM D-790
3. Flexural Modulus = 1,124,000 psi per ASTM D-790
4. Elongation Break = 11.07% per ASTM D-638
5. Specific Gravity = 1.38 per ASTM D-792

B. Models LS200-275-300-315 shall incorporate the most current Link-Seal® Modular Seal design modifications and shall include an integrally molded compression assist boss on the top (bolt entry side) of the pressure plate, which permits increased compressive loading of the rubber sealing element. Models 315-325-340-360-400-410-425-475-500-525-575-600 shall incorporate an integral recess known as a “Hex Nut Interlock” designed to accommodate commercially available fasteners to insure proper thread engagement for the class and service of metal hardware. All pressure plates shall have a permanent identification of the manufacturer’s name molded into it.

C. For fire service, pressure plates shall be steel with 2-part Zinc Dichromate Coating.

D. Link-Seal® Modular Seal Hardware: All fasteners shall be sized according to latest Link-Seal® modular seal technical data. Bolts, flange hex nuts shall be:

1. 316 Stainless Steel per ASTM F593-95, with a 85,000 psi average tensile strength.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.

M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. PVC Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of

components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section “Miscellaneous Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.9 LINK SEAL

A. Provide Link Seal at all piping penetrations from the outside.

END OF SECTION 230500

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when the requirements in equipment schedules, other specification sections, drawing notes or in other contract documents are more stringent.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Motors 3/4 HP and larger: Polyphase.

D. Motors smaller than 3/4 HP: Single phase.

E. All motors shall have ASTM Grade 5 hardware that is Yellow Zinc-dichromate plated.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Rotor: Random-wound, squirrel cage.

E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating.

G. Insulation: Class F.

H. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors smaller than 15 HP: Manufacturer's standard starting characteristic.

I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class F insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

5. Shaft Grounding Ring: Microfiber type.

   a. Provide grounded discharge path for VFD induced voltage in the shaft to prevent arching in the motor bearings.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 ELECTRONICALLY COMMUTATED MOTOR (ECM)

A. Motor enclosures: Open type

B. Motor to be a DC electronic commutation type motor (ECM).

   1. AC induction type motors are not acceptable.

C. Permanently lubricated motor with heavy duty ball bearing

D. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.

E. Speed controllable to 20% of full speed (80% turndown).

   1. Potentiometer dial mounted at the motor speed controller or 0-10 VDC signal.

F. 85% efficient at all speeds minimum.

G. Motors smaller than 2.0 hp.

2.6 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

   1. Permanent-split capacitor.
   2. Split phase.
   3. Capacitor start, inductor run.
   4. Capacitor start, capacitor run.

B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range, unless otherwise indicated.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230516

EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Slip-joint packed expansion joints.
2. Expansion-compensator packless expansion joints.
3. Flexible-hose packless expansion joints.
4. Metal-bellows packless expansion joints.
5. Pipe loops and swing connections.
6. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of expansion joint, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code - Steel."
2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 PACKED EXPANSION JOINTS

A. Slip-Joint Packed Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adsco Manufacturing LLC.
b. Advanced Thermal Systems, Inc.
c. Hyspan Precision Products, Inc.
d. Twin City Hose

2. Standard: ASTM F 1007.
3. Material: Carbon steel with asbestos-free PTFE packing.
4. Design: With internal guide and injection device for repacking under pressure. Include drip connection if used for steam piping.
5. Configuration: Single joint class unless otherwise indicated.
6. End Connections: Flanged or weld ends to match piping system.

2.2 PACKLESS EXPANSION JOINTS

A. Metal, Expansion-Compensator Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adsco Manufacturing LLC.
b. Flexicraft Industries.
c. Flex Pression Ltd.
d. Flex-Weld, Inc.
e. Hyspan Precision Products, Inc.
f. Metraflex, Inc.
g. Senior Flexonics Pathway.
h. Unaflex.
i. Unisource Manufacturing, Inc.
j. Twin City Hose

2. Minimum Pressure Rating: 175 psi unless otherwise indicated.

3. Configuration for Copper Tubing: Two-ply, phosphor-bronze bellows with copper pipe ends.

   a. End Connections for Copper Tubing NPS 2 and Smaller: Threaded.
   b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.

4. Configuration for Steel Piping: Two-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.

   a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
   b. End Connections for Steel Pipe NPS 2-1/2 to NPS 4: Flanged.

B. Flexible-Hose Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flex-Hose Co., Inc.
   b. Flexicraft Industries.
   c. Flex Pression Ltd.
   d. Flex-Weld
   e. Fugate
   f. Metraflex, Inc.
   g. Twin City Hose

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.

3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.

4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with threaded solder-joint end connections.

   a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.

5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded solder-joint end connections.

   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

6. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon-steel fittings with threaded end connections.

   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.

7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.

a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

8. Expansion Joints for Steel Piping NPS 8 to NPS 12: Carbon-steel with flanged end connections.

a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg Fand 90 psig at 600 deg Fratings.

9. Expansion Joints for Steel Piping NPS 14 and Larger: Carbon-steel fittings with flanged end connections.

a. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.

C. Metal-Bellows Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flex-Hose Co., Inc.
b. Flexicraft Industries.
c. Flex Pression Ltd.
d. Flex-Weld, Inc.
e. Flo Fab inc.
f. Hyspan Precision Products, Inc.
g. Metraflex, Inc.
h. Twin City Hose

2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
3. Type: Circular, corrugated bellows with external tie rods.
4. Minimum Pressure Rating: 175 psig unless otherwise indicated.
5. Configuration: Single joint class unless otherwise indicated.
6. Expansion Joints for Copper Tubing: Single-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.

a. End Connections for Copper Tubing NPS 2 and Smaller: Threaded.
b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.
c. End Connections for Copper Tubing NPS 5 and Larger: Flanged.

7. Expansion Joints for Steel Piping: Single-ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.

a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
b. End Connections for Steel Pipe NPS 2-1/2 and Larger: Flanged.

2.3 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Adsco Manufacturing LLC.
    b. Advanced Thermal Systems, Inc.
    c. Flex-Hose Co., Inc.
    d. Flexicraft Industries.
    e. Flex-Weld, Inc.
    f. Hyspan Precision Products, Inc.
    g. Metraflex, Inc.
    h. Piping Technology & Products, Inc.
    i. Senior Flexonics Pathway.
    j. Twin City Hose.

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Stud: Threaded, zinc-coated carbon steel.
    b. Expansion Plug: Zinc-coated steel.
    c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Bonding Material: ASTM C 881, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
    b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
    c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install packed-type expansion joints with packing suitable for fluid service.

C. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one guide on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 230516

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230517

SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Industries, LLC.

C. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. HOLDRITE.

C. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide Insert dimension annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
4. For sound-rated partitions, fill the opening between sleeve and piping with insulation prior to sealing.

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
b. Piping NPS 6 and Larger: Cast-iron wall sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 230517

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230518

ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated or rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type with polished, chrome-plated finish.

b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.

c. Insulated Piping: One-piece, stamped-steel type with chrome-plated finish.

d. Bare Piping 2 inch and Smaller at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

e. Bare Piping Larger than 2 inch at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type with polished, chrome-plated finish.

f. Bare Piping 2 inch and Smaller at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

g. Bare Piping Larger than 2 inch at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type with polished, chrome-plated finish.

h. Bare Piping 2 inch and Smaller in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated.

i. Bare Piping Larger than 2 inch in Unfinished Service Spaces: One-piece, stamped-steel type with polished, chrome-plated finish.

j. Bare Piping 2 inch and Smaller in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.

k. Bare Piping in Equipment Rooms Larger than 2 inch: One-piece, stamped-steel type with chrome- or cadmium-plated finish.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230519

METERS AND GAGES FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.
7. Flowmeters.

B. Related Sections:

1. Division 23 Section "Facility Natural-Gas Piping" for gas meters.
2. Division 23 Section "Steam and Condensate Heating Piping" for steam and condensate meters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Palmer Wahl Instrumentation Group.

   b. Trerice, H. O. Co.

   c. Weiss Instruments, Inc.

   d. Weksler.

2. Standard: ASME B40.200.
3. Case: Die Cast aluminum or brass; nominal size unless otherwise indicated.
4. Case Form: Adjustable angle type unless otherwise indicated, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Satin faced, nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Copper-plated steel, aluminum, stainless steel, or brass designed for thermowell installation. Stem shall be of length to match thermowell insertion length.

   a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMETEK, Inc.; U.S. Gauge Div.
   b. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
   c. Ernst Gage Co.
   d. Marsh Bellofram.
   e. Miljoco Corp.
   f. NANMAC Corporation.
   g. Noshok, Inc.
   h. Palmer - Wahl Instruments Inc.
   i. REO TEMP Instrument Corporation.
   j. Tel-Tru Manufacturing Company.
   k. Trerice, H. O. Co.
   l. Weiss Instruments, Inc.
   m. Weksler

n. WIKA Instrument Corporation.
o. Winters Instruments.

2. Manufacturers: Same as manufacturer of thermometer being used.
3. Standard: ASME B40.200.
4. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
5. Material for Use with Copper Tubing: Brass.
6. Material for Use with Steel Piping: Brass.
7. Type: Stepped shank unless straight or tapered shank is indicated.
8. External Threads: NPS 1/2, NPS 3/4, NPS 1 or NPS 1-1/4 ASME B1.20.1 pipe threads.

9. Internal Threads: 1/2, 3/4, and 1 inch with ASME B1.1 screw threads.
10. Bore: Diameter required to match thermometer bulb or stem.
11. Insertion Length: Length required to match thermometer bulb or stem.
12. Lagging Extension: Include on thermowells for insulated piping and tubing.
13. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Ernst Flow Industries.
d. KOBOLD Instruments, Inc.
e. Marsh Bellofram.
f. Miljoco Corporation.
g. Noshok.
h. Palmer Wahl Instrumentation Group.
i. REOTEMP Instrument Corporation.
j. Trerice, H. O. Co.
k. Weiss Instruments, Inc.
l. Weksler
m. WIKA Instrument Corporation.
n. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2-inchnominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated. NPS 1/4 or NPS 1/2.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Satin faced, nonreflective aluminum with permanently etched scale markings graduated in psi .
8. Pointer: Dark-colored metal.
9. Window: Glass.

10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. KOBOLD Instruments, Inc.
   e. Marsh Bellofram.
   f. Miljoco Corporation.
   g. Noshok.
   h. Palmer Wahl Instrumentation Group.
   i. REOTEMP Instrument Corporation.
   j. Trerice, H. O. Co.
   k. Weiss Instruments, Inc.
   l. Weksler
   m. WIKA Instrument Corporation.

   n. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled, cast aluminum or drawn steel; diameter with back flange for panel surface mounting or front flange for panel recessed mounting. Flanges to include pre-drilled screw holes.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated. NPS 1/4 or NPS 1/2.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Satin faced, nonreflective aluminum with permanently etched scale markings graduated in psi .
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with ASME B1.20.1 pipe threads. Include extension for use on insulated piping. NPS 1/4 or NPS 1/2 .

1. Surge-dampening device: porous-metal-type.

B. Siphons:

1. Loop-shaped section: Brass pipe with pipe threads. NPS 1/4 or NPS 1/2.

C. Valves:

1. Needle: Brass, with NPS 1/4 or NPS 1/2 ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Twin City Hose.
8. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
9. Welsler.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: or , ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating:

F. Core Inserts: Self-sealing synthetic rubber;

1. EPDM (Nordel) for air, water or glycol operation between 30 and 275 deg F.

2. CR (Neoprene) for air, water, glycol, oil, or gas operation between -30 to 200 deg F.

2.6 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Furnish the number of test-plug kits given below with the number of thermometers given below, with each kit having one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

1. Low-Range Thermometer: Small, bimetallic insertion type with 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F .
2. High-Range Thermometer: Small, bimetallic insertion type with 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F .
3. Pressure Gage: Small, Bourdon-tube insertion type with 3-inch diameter dial and probe. Dial range shall be at least to 200 psig.
4. Carrying Case: Metal or plastic, with formed instrument padding.
5. One test-plug kit with:

    a. Two thermometers.

2.7 FLOWMETERS

A. Orifice Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB; Instrumentation and Analytical.
    b. Armstrong Pumps Inc.; S. A. Armstrong Limited.
    c. Badger Meter, Inc.; Industrial Div.
    d. Bell & Gossett; ITT Industries.
    e. Meriam Process Technologies.

2. Description: Flowmeter with sensor, hoses or tubing, quick connect hose fittings, valves, indicator, and conversion chart.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Wafer-orifice-type, calibrated, flow-measuring element; for installation between pipe flanges.

    a. Design: Differential-pressure-type measurement:

        1) For HVAC hot and chilled water.
    b. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.
    c. Minimum Pressure Rating: 300 psig.
    d. Minimum Temperature Rating: 250 deg F .

5. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected sensor and having two 12-foot hoses, with carrying case.

    a. Scale: Gallons per minute.
    b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.

6. Conversion Chart: Flow rate data compatible with sensor and indicator.
7. Operating Instructions: Include complete instructions with each flowmeter.

B. Venturi Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong Pump
b. Badger Meter, Inc.; Industrial Division
c. Bailey-Fischer & Porter Co.
d. Flow Design, Inc.
e. Gerand Engineering Co.
f. Hyspan Precision Products, Inc.
g. Leeds & Northrup.
h. McCrometer, Inc.
i. Preso Meters; a division of Racine Federated Inc.
j. Victaulic Company.

2. Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, quick connect hose fittings, valves, indicator, and conversion chart.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Venturi-type, calibrated, flow-measuring element; for installation in piping.

a. Design: Differential-pressure-type measurement for water.
b. Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
c. Minimum Pressure Rating: 250 psig.
d. Minimum Temperature Rating: 250 deg F.
e. End Connections for NPS 2 and Smaller: Threaded.
f. End Connections for NPS 2-1/2 and Larger: Flanged or welded.
g. Flow Range: Flow-measuring element and flowmeter shall cover operating range of equipment or system served.

C. Vortex-Shedding Flowmeters: (Steam Service)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB; Instrumentation and Analytical.
b. Eastech Flow Controls.
c. EMCO Flow Systems; a division of Spirax Sarco, Inc.
d. Emerson Process Management; Rosemount.
e. Endress+Hauser.
f. ISTEC Corporation.
g. ONICON Incorporated

2. Description: Flowmeter with sensor and indicator.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Inline type; for installing between pipe flanges and measuring flow directly in .

a. Design: Flow obstruction device, vortex-measurement type for steam.
b. Construction: Stainless-steel body, with integral transmitter and direct-reading scale.
c. Minimum Pressure Rating: 100 psig.
d. Minimum Temperature Rating: 400° F.

e. Integral Transformer: For low-voltage power operation.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Accuracy: Plus or minus 0.25 percent for liquids and 0.75 percent for gases.
7. Display: Shows rate of flow, with register to indicate total volume in lbs/hr.
8. Operating Instructions: Include complete instructions with each flowmeter.

D. Turbine Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ABB; Instrumentation and Analytical.
   b. Data Industrial Corp.
   c. EMCO Flow Systems; a division of Spirax Sarco, Inc.
   d. ERDCO Engineering Corp.
   e. Hoffer Flow Controls, Inc.
   f. Liquid Controls; a unit of IDEX Corporation.
   g. McCrometer, Inc.
   h. Midwest Instruments & Controls Corp.
   i. ONICON Incorporated.
   j. SeaMetrics, Inc.
   k. Sponsler, Inc.; a unit of IDEX Corporation.

2. Description: Flowmeter with sensor and indicator.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Impeller turbine; for inserting into pipe fitting or for installing in piping and measuring flow directly in gallons per minute.

   a. Design: Device or pipe fitting with inline turbine and integral direct-reading scale for water.
   b. Construction: Bronze or stainless-steel body, with plastic turbine or impeller.
   c. Minimum Pressure Rating: 150 psig.
   d. Minimum Temperature Rating: 180 deg F.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Accuracy: Plus or minus 1-1/2 percent.
7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Operating Instructions: Include complete instructions with each flowmeter.

2.8 THERMAL-MASS FLOW METERS (Natural Gas Service)

A. Thermal-Mass Flow Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Data Industrial Corp.
   b. Hoffer Flow Controls, Inc.
   c. ISTEC Corporation.
   d. ONICON Incorporated.

2. Description: System with flow sensor, transmitter, indicator, and connecting wiring.

3. Flow Sensor: Corrosion-resistant-metal body and transmitter; for installing in piping.

   a. Design: Total flow measurement.
   b. Operating Pressure Rating: 250 PSI Maximum
   c. Ambient Temperature Range: 0°F to 150° F
   d. Fluid Temperature Range: -40°F to 150°F

4. Temperature Sensors: Insertion-type transducer.
5. Indicator: Solid-state, integrating-type meter with pulse meter display with network connections for BACnet BMS system; for wall mounting.
6. Accuracy: Plus or minus 2 percent.
7. Display: Visually indicates total fluid volume in Cubic Feet/Hr.
8. Operating Instructions: Include complete instructions with each meter system.

2.9 ELECTROMAGNETIC FLOW METERS (Water Service)

A. Electromagnetic Flow Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Data Industrial Corp.
   b. Hoffer Flow Controls, Inc.
   c. ISTEC Corporation.
   d. ONICON Incorporated.

2. Description: System with electromagnetic sensing flow sensor, transmitter, indicator, and connecting wiring.
3. Flow Sensor: Corrosion-resistant-metal body and transmitter; for installing in piping.

   a. Design: Total flow measurement.
   b. Operating Pressure Rating: 400 PSI Maximum
   c. Ambient Temperature Range: -20° F to 150° F
   d. Fluid Temperature Range: 15° F to 250° F

4. Temperature Sensors: Insertion-type transducer.
5. Indicator: Solid-state, integrating-type meter with analog meter display with network connections for BACnet BMS system; for wall mounting.
6. Accuracy: Plus or minus 2 percent.
7. Display: Visually indicates total fluid volume in Cubic Feet/Hr.
8. Operating Instructions: Include complete instructions with each meter system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells: with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions to most readable position.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install needle-valve and snubber in piping for each pressure gage for fluids. Exception: Steam.

H. Install test plugs in piping tees.

I. Install flow indicators in piping systems in accessible positions for easy viewing.

J. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

K. Install flowmeter elements in accessible positions in piping systems.

L. Install wafer-orifice flowmeter elements between pipe flanges.

M. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

N. Install permanent indicators on walls or brackets in accessible and readable positions.

O. Install connection fittings in accessible locations for attachment to portable indicators.

P. Mount meters on wall if accessible; if not, provide brackets to support meters.

Q. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic boiler.
2. Two inlets and two outlets of each chiller.
3. Inlet and outlet of each hydronic coil in air-handling units.
4. Two inlets and two outlets of each hydronic heat exchanger.
5. Inlet and outlet of each thermal-storage tank.
6. Inlet and outlet of each piece of steam equipment.

R. Install pressure gages in the following locations:

1. Inlet and discharge of each pressure-reducing valve.
2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
3. Suction and discharge of each pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic zone shall be the following:

1. Test plug: With EPDM self-sealing rubber inserts.

B. Thermometers at inlet and outlet of each hydronic boiler shall be the following:

1. Industrial-style, liquid-in-glass type.

C. Thermometers at inlets and outlets of each chiller shall the following:

1. Industrial-style, liquid-in-glass type.

D. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be the following:

1. Industrial-style, liquid-in-glass type.

E. Thermometers at inlet and outlet of each hydronic coil at fan coils, cabinet heaters, unit heaters and reheat coils and as shown on details shall be the following:

1. Industrial-style, liquid-in-glass type.
2. Test plug with EPDM self-sealing rubber inserts.

F. Thermometers at inlets and outlets of each hydronic heat exchanger shall be the following:

1. Industrial-style, liquid-in-glass type.

G. Thermometers at inlet and outlet of each hydronic heat-recovery unit shall be the following:

1. Industrial-style, liquid-in-glass type.

H. Thermometers at inlet and outlet of each thermal-storage tank shall be the following:

1. Industrial-style, liquid-in-glass type.

I. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 deg F.

B. Scale Range for Condenser-Water Piping: 0 to 150 deg F.

C. Scale Range for Heating, Hot-Water Piping: 30 to 240 deg F.

D. Scale Range for Steam and Steam-Condensate Piping: 30 to 240 deg F.

E. Scale Range for Air Ducts: Minus 40 to plus 110 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at inlet and discharge of each pressure-reducing valve shall be the following:

1. Dry-case type, direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be the following:

1. Liquid-filled, direct-mounted, metal case.

C. Pressure gages at suction and discharge of each pump shall be the following:

1. Liquid-filled, direct-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water, Condenser-Water, Heating, Hot-Water, Steam and Condensate Piping shall be twice the normal operating pressure of the measured system with gage ranges as follows:

1. 30 in. Hg to 15 psi.
2. 0 to 30 psi.
3. 0 to 100 psi.
4. 0 to 160 psi.
5. 0 to 200 psi.
6. 0 to 300 psi.
7. 0 to 600 psi.

3.8 FLOWMETER SCHEDULE. See flow meter schedule on drawings for flowmeter type.

END OF SECTION 230519

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230523

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Iron, single-flange butterfly valves.
3. Bronze lift check valves.
4. Bronze swing check valves.
5. Iron swing check valves.
6. Bronze globe valves.
7. Iron globe valves.
8. Lubricated plug valves.
9. Chainwheels.
10. High-performance butterfly valves.

B. Related Sections:

1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated. Body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

B. Maintenance data for valves to be included in the operation and maintenance data specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve as listed in SUMMARY from a single source and from a single manufacturer.

B. Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.
4. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set angle, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller[except plug valves].
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.

a. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg. For, globe, and check valves: below 421 deg. F for ball valves.

3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. APCO Willamette Valve and Primer Corp.
2. Babbitt Steam Specialty Company.
3. Bray Controls.
4. Center Line.
5. Cla-Val Company.
6. Conbraco Industries Inc.
7. Crane Co.; Crane Valve Group.
8. Fisher Valve by Emerson.
9. Flo Fab Inc.
10. Flow-Tek Inc.
11. Grinnell Corporation.
12. Hammond Valve.
13. Jamesbury; a subsidiary of Metso Automation.
14. Jomar International LTD.

15. Keystone Valve USA, Inc.
16. Kitz Corp.
17. Metraflex Company.
18. Milwaukee Valve Company.
19. Mueller Steam Specialty.
20. NIBCO Inc.
21. Red-White Valve Corp.
22. Spence Strainers International.
23. Stockham Valves and Fittings, Inc.
24. Tyco Fire/Shurjoint Piping Products.
25. Tyco/Pentair LTD.
26. Val-Matic Valve & Mfg. Corp.
27. Victaulic Company.
28. Watts Regulator Company.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange (Lug) Butterfly Valves:

1. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 150 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nylon 11 coated ductile iron.

B. 175 CWP, Iron, Single-Flange (Lug) Butterfly Valves:

1. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 175 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nylon 11 coated ductile iron.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Nylon 11 coated ductile Iron Disc:

1. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nylon 11 coated ductile iron.

D. 250 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Nylon 11 coated ductile Iron Disc:

1. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 250 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nylon 11 coated ductile iron.

2.5 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valve:

1. Description:

a. Standard: MSS SP-80.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61, ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze, Type 1.

2.6 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.7 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.8 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Teflon impregnated, asbestos free.
h. Handwheel: Malleable iron.

2.9 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.

e. Stem: Brass alloy. OS &Y.
f. Disc: Renewable bronze seat.
g. Trim: Bronze.
h. Packing and Gasket: Teflon impregnated, asbestos free.
i. Handwheel: Cast iron

2.10 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Description:

a. Standard: MSS SP-78, Type II.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. Pattern: Regular or short.
d. Body Material: ASTM A 48 or ASTM A 126, cast iron with lubrication-sealing system.

e. Plug: Cast iron or bronze with sealant groove.

2.11 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to [ball] [butterfly] [and] [plug] valve stems.
3. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve. Include zinc coating.
4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

2.12 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 300, Single-Flange, High-Performance Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Cooper Cameron Valves; a division of Cooper Cameron Corp.
d. Crane Co.; Crane Valve Group; Flowseal.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Hammond Valve.
h. Jamesbury; a subsidiary of Metso Automation.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Process Development & Control, Inc.
l. Tyco Valves & Controls; a unit of Tyco Flow Control.
m. Xomox Corporation.

2. Description:

   a. Standard: MSS SP-68.
   b. CWP Rating: 720 psig at 100 deg F.
   c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
   d. Body Material: Carbon steel, cast iron, or ductile iron.
   e. Seat: Reinforced PTFE or metal.
   f. Stem: Stainless steel; offset from seat plane.
   g. Disc: Carbon steel.
   h. Service: Bidirectional.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance3 with requirements for installation tolerances and other conditions affecting performance of valves. Do no proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves as indicated, according to manufacturer’s written instructions.

B. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

C. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above center of pipe.

F. Install valves in position to allow full stem movement.

G. Install chainwheels on operators for ball, butterfly globe and plug valves NPS 4 and larger and more than 96 inches above floor.

H. Extend the chainwheels for chains to 60 inches above finished floor.

I. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.
4. Install all check valves a minimum of five pipe diameters downstream of pump discharge or elbow to avoid flow turbulence. In extreme cases add flow straighteners as required to correct the turbulence.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or butterfly valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service except Steam: Globe valves.
4. Throttling Service, Steam: Globe valves.
5. Pump-Discharge Check Valves:

   a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
   b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, metal-seat check valves.

6. Drain Service (except Steam): Two-Piece, Full Port Bronze Ball Valves with Bronze Trim. To be installed with NPS ¾ hose thread outlet and hose cap with chain.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 CHILLED-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves:

a. Piece: Two
b. Port: Full.
c. Material/Trim: Bronze with:

1) Bronze trim.

3. Bronze Swing Check Valves:

a. Class 150
b. Bronze disc.

4. Bronze Globe Valves:

a. Class 125

b. Bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12:

a. 200 CWP,
b. Seat: EPDM.
c. Disc: Ductile-iron.

3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Globe Valves: Class 125.
5. Lubricated Plug Valves: Class 125, regular gland, flanged.

3.6 CONDENSER-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves:

a. Piece: Two
b. Port: Full.

c. Material/Trim: Bronze with:

1) Bronze trim.

3. Bronze Swing Check Valves:

a. Class 150
b. Bronze disc.

4. Bronze Globe Valves:

a. Class 125
b. Bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12:

a. 200 CWP,
b. Seat: EPDM.
c. Disc: Ductile-iron.

3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring.
5. Iron Globe Valves: Class 125.
6. Lubricated Plug Valves: Class 125, regular gland, flanged.

3.7 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.

2. Ball Valves:

a. Piece: Two
b. Port: Full.
c. Material/Trim: Bronze with:

1) Bronze trim.

3. Bronze Swing Check Valves:

a. Class 150
b. Bronze disc.

4. Bronze Globe Valves:

a. Class 125
b. Bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12:

   a. 200 CWP,
   b. Seat: EPDM.
   c. Disc: Ductile-iron.

3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Globe Valves: Class 125.

3.8 LOW-PRESSURE STEAM VALVE SCHEDULE (15 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:

1. Ball Valves:

   a. Piece: Two
   b. Port: Full.
   c. Material/Trim: Bronze with:

      1) Bronze trim.

2. Bronze Swing Check Valves:

   a. Class 150
   b. Bronze disc.

3. Bronze Globe Valves:

   a. Class 125
   b. Bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, metal seats.
3. Iron Globe Valves: NPS 2-1/2 to NPS 12: Class 125.
4. High-Performance Butterfly Valves: Class 300, single flange.

3.9 HIGH-PRESSURE STEAM VALVE SCHEDULE (MORE THAN 15 PSIG)

A. Pipe NPS 2 and Smaller:

1. Ball Valves:

   a. Piece: Two
   b. Port: Full.

c. Material/Trim: Bronze with:

1) Bronze trim.

2. Bronze Swing Check Valves:

a. Class 150
b. Bronze disc.

3. Bronze Globe Valves:

a. Class 125
b. Bronze disc.

B. Pipe Sizes NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, metal seats.
3. Iron Globe Valves: NPS 2-1/2 to NPS 12: Class 125.
4. High-Performance Butterfly Valves: Class 300, single flange.

3.10 STEAM-CONDENSATE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Ball Valves:

a. Piece: Two
b. Port: Full.
c. Material/Trim: Bronze with:

1) Bronze trim.

2. Bronze Swing Check Valves:

a. Class 150
b. Bronze disc.

3. Bronze Globe Valves:

a. Class 125
b. Bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, metal seats.
3. Iron Globe Valves: NPS 2-1/2 to NPS 12: Class 125.
4. Lubricated Plug Valves: Class 125, regular gland, flanged.

5. High-Performance Butterfly Valves: Class 300, single flange.

END OF SECTION 230523

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.

B. Related Sections:

1. Division 05 for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
3. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped. Use for exposed to weather / outdoors. (BA1)
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO/Michigan Hanger Co. ; ERISTRUT Div.
d. GS Metals Corp.
e. Hilti, Inc.insert manufacturer's name.
f. Power-Strut Div. Tyco International.
g. Thomas & Betts Corporation.
h. Tolco Inc.
i. Unistrut; an Atkore International company.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating:

    a. Electroplated zinc.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International; a subsidiary of Mueller Water Products, Inc.
    b. Empire Industries, Inc.
    c. ERICO International Corporation.
    d. Haydon Corporation.
    e. NIBCO INC.
    f. PHD Manufacturing, Inc.
    g. PHS Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating:

    a. Zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields Inc.
7. Piping Technology & Products, Inc.

8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping:

1. Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

C. Insulation-Insert Material for Hot Piping:

1. Water-repellent treated, ASTM C 533, Type I calcium silicate Asbestos Free with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis ~~or Band Hangers~~: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless-] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.

b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230548

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SCOPE

A. Provide engineered vibration isolation and restraint systems in accordance with the requirements of this section including design, engineering, materials, testing, inspections and reports.

B. Mechanical equipment with moving parts shall be mounted on or suspended from vibration isolators to reduce the transmission of vibration and mechanically transmitted sound to the building structure.

C. All mechanical equipment, piping and ductwork shall be restrained as required by Federal, State and Local building codes to preserve the integrity of nonstructural building components during seismic events to minimize hazards to occupants and reduce property damage.

1.3 SUMMARY

A. This Section includes the following:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Air-spring isolators.

11. Restrained-air-spring isolators.
12. Elastomeric hangers.
13. Spring hangers.
14. Snubbers.
15. Restraint channel bracings.
16. Restraint cables.
17. Seismic-restraint accessories.
18. Mechanical anchor bolts.
19. Adhesive anchor bolts.

20. Vibration isolation equipment bases.
21. Restrained isolation roof-curb rails.
22. Certification of seismic restraint designs.
23. Installation supervision.
24. Design of attachment of housekeeping pads.
25. All components requiring IBC compliance and certification.
26. All inspection and test procedures for components requiring IBC compliance.
27. Restraint of all mechanical equipment, pipe and ductwork, within, on, or outdoors of the building and entry of services to the building, up to but not including, the utility connection, is part of this Specification.
28. Seismic certification of equipment

B. Related Requirements:

1. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.

1.4 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. ASCE: American Society of Civil Engineers

D. Ip: Importance Factor.

E. ESSENTIAL FACILITIES, (Occupancy Category IV, IBC-2018)

1. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes.

F. LIFE SAFETY

1. All systems involved with fire protection, including sprinkler piping, jockey pumps, fire pumps, control panels, service water supply piping, water tanks, fire dampers, smoke exhaust systems and fire alarm panels.
2. All mechanical, electrical, plumbing or fire protection systems that support the operation of, or are connected to, emergency power equipment, including all lighting, generators, transfer switches and transformers.
3. All medical and life support systems.
4. Hospital heating systems and air conditioning systems for maintaining normal ambient temperature.
5. Automated supply, exhaust, fresh air and relief air systems on emergency control sequence, including air handlers, duct, dampers, etc., or manually-operated systems used for smoke evacuation, purge or fresh air relief by the fire department.
6. Heating systems in any facility with Occupancy Category IV, IBC-2018 where the ambient temperature can fall below 32 degrees Fahrenheit.

G. HIGH HAZARD

1. All gases or fluids that must be contained in a closed system which are flammable or combustible. Any gas that poses a health hazard if released into the environment and vented Fuel Cells.

1.5 REFERENCE CODES AND STANDARDS

A. Codes and Standards: The following shall apply and conform to good engineering practices unless otherwise directed by the Federal, State or Local authorities having jurisdiction.

1. IBC
2. ASCE 7
3. NFPA 13 (National Fire Protection Association)
4. IBC 2018

B. The following guides may be used for supplemental information on typical seismic installation practices. Where a conflict exists between the guides and these construction documents, the construction documents will preside.

1. FEMA (Federal Emergency Management Agency) manuals 412, Installing Seismic Restraints for Mechanical Equipment and 414, Installing Seismic Restraints for Ductwork and Pipe.
2. SMACNA (Sheet Metal and Air-conditioning Contractors' National Association) Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd ed.
3. ASHRAE (American Society for Heating, Refrigerating and Air-conditioning Engineers) A Practical Guide to Seismic Restraint
4. MSS (Manufacturers Standardization Society of the Valve and Fittings Industry) MSS SP-127, Bracing for Piping Systems, Seismic – Wind – Dynamic, Design, Selection, Application.

1.6 ISOLATOR AND RESTRAINT MANUFACTURER'S RESPONSIBILITIES:

A. Provide project specific vibration isolation and seismic restraint design prepared by a registered design professional in the state were the project is being constructed, and manufacturer certifications that the components are seismically qualified.

1. Provide calculations to determine restraint loads resulting from seismic forces as required by IBC, Chapter 16 and ASCE 7, latest editions. Seismic calculations shall be certified by an engineer licensed in the state where the project is being constructed.

B. Provide installation instructions and shop drawings for all materials supplied under this section of the specifications.

1. Provide seismic restraint details with specific information relating to the materials, type, size, and locations of anchorages; materials used for bracing; attachment requirements of bracing to structure and component; and locations of transverse and longitudinal sway bracing and rod stiffeners.
2. Provide seismic bracing layout drawings indicating the location of all seismic restraints.

    a. Each piece of rotating isolated equipment shall be tagged to clearly identify quantity

and size of vibration isolators and seismic restraints.

C. Provide, in writing, the special inspection requirements for all Designated Seismic Systems as indicated in Chapter 17 of the IBC.

D. Provide training for installation, operation and maintenance of isolation and restraint systems.

1.7 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading: Per the structural drawings and specifications.

B. Flood-Restraint Loading: Per the structural drawings and specifications.

C. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: Per the structural drawings and specifications. See structural general notes drawing S-001.

2. Assigned Occupancy Category as Defined in the IBC: Per the structural drawings and specifications.

a. Component Importance Factor: 1.5.

1) Life safety components required to function after an earthquake.
2) Components containing hazardous or flammable materials in quantities that exceed the exempted amounts for an open system listed in Chapter 4.
3) For structures with an Occupancy Category IV, components needed for continued operation of the facility or whose failure could impair the continued operation of the facility.
4) Storage racks in occupancies open to the general public (e.g., warehouse retail stores).

b. Component Importance Factor: 1.0.

1) All other components

c. Component Response Modification Factor: Per the structural drawings and specifications.
d. Component Amplification Factor: Per the structural drawings and specifications.

3. Design Spectral Response Acceleration at Short Periods: Per the structural drawings and specifications.
4. Design Spectral Response Acceleration at 1-Second Period: Per the structural drawings and specifications.

1.8 ACTION SUBMITTALS

A. Product Data: For the following:

1. Submittals shall include catalog cut sheets and installation instructions for each type of anchor and seismic restraint used on equipment or components being isolated and/or

restrained.

2. Submittals for mountings and hangers incorporating springs shall include spring diameter and free height, rated load, rated deflection, and overload capacity for each vibration isolation device.
3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

4. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. “Basis for Design” report: Statement from the registered design professional that the design complies with the requirements of the ASCE 7-05 Chapter 13, IBC 2052 chapter 1912 and ACI 318. In addition, the basis for compliance must also be noted, as listed below:

    a. Project specific design documentation prepared and submitted by a registered design professional (ASCE 7, 13.2.1.1)
    b. Submittal of the manufacturer’s certification that the isolation equipment is seismically qualified by:
    c. An engineered analysis conforming to the requirements of Chapter 13 of ASCE 7.
    d. Testing by a nationally recognized testing standard procedure such as ICC-ES AC 156. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
    e. Experience data conforming to a nationally recognized procedure. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.

2. Seismic restraint load ratings must be certified and substantiated by testing or calculations under direct control of a registered professional engineer. Copies of testing and calculations must be submitted as part of submittal documents.
3. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.

a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.

5. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
6. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
7. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.9 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

1. Submittal drawings and calculations must be stamped by a registered professional engineer in the State where the project is being constructed who is responsible for the seismic restraint design.
2. Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. All bolts shall be ASTM A307 or better.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control test reports.

1.10 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are

more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.11 SEISMIC CERTIFICATION OF EQUIPMENT

A. Component Importance Factor. All plumbing and mechanical components shall be assigned a component importance factor. The component importance factor, I*p*, shall be taken as 1.5 if any of the following conditions apply:

1. The component is required to function for life-safety purposes after an earthquake.
2. The component contains hazardous materials.
3. The component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.

B. All other components shall be assigned a component importance factor, I*p*, equal to 1.0.

C. For equipment or components where I*p* = 1.0.

1. Submit manufacturer's certification that the equipment is seismically qualified by:

a. An engineered analysis conforming to the requirements of Chapter 13 of ASCE 7.
b. Testing by a nationally recognized testing standard procedure such as ICC-ES AC 156. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
c. Experience data conforming to a nationally recognized procedure. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.

2. The equipment and components listed below are considered rugged and shall not require Special Seismic Certification:

a. Valves (not in cast-iron housings, except for ductile cast iron).
b. Pneumatic operators.
c. Hydraulic operators.
d. Motors and motor operators.
e. Horizontal and vertical pumps (including vacuum pumps).
f. Air compressors
g. Refrigerators and freezers.
h. Elevator cabs.
i. Underground tanks.
j. Equipment and components weighing not more than 20 lbs. supported directly on

structures (and not mounted on other equipment or components) with supports and attachments in accordance with Chapter 13, ASCE 7.

3. Rugged equipment and components in this section are for factory assembled discrete equipment and components only and do not apply to site assembled or field assembled equipment or equipment anchorage.

D. Special Certification requirements for Designated Seismic Systems (i.e. *Ip* = 1.5): Seismic Certificates of Compliance supplied by manufacturers shall be submitted for all components that are part of Designated Seismic Systems. In accordance with the ASCE 7, certification shall be via one of the following methods:

1. For active mechanical and electrical equipment that must remain operable following the design earthquake:

   a. Testing as detailed by part C.1.b above.
   b. Experience data as detailed by part C.1.c above.
   c. Equipment that is considered “rugged” per part C.2 above.

2. Components with hazardous contents shall be certified by the manufacturer as maintaining containment following the design earthquake by:

   a. Testing as detailed by part C.1.b above.
   b. Experience data as detailed by part C.1.c above.
   c. Engineering analysis utilizing dynamic characteristics and forces. Tanks (without vibration isolators) designed by a registered design professional in accordance with ASME Boiler and Pressure Vessel Code, and satisfying the force and displacement requirements of Sections 13.3.1 and 13.3.2 of ASCE 7 having an importance factor, I*p* = 1.0 shall be considered to satisfy the Special Seismic Certification requirements on the basis of ASCE 7 Section 13.6.9.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. CalDyn (California Dynamics Corporation).
3. ISAT (International Seismic Application Technology).
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibro-Acoustics
7. VMC (Vibration Mountings & Controls, Inc.)

Copy paragraph and subparagraph below for each type of pad configuration required for Project. Use drawing designation and coordinate with the HVAC Vibration-Control and Seismic-Restraint Device Schedule on Drawings.

B. Elastomeric Isolation Pads P1:

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
2. Size: Factory or field cut to match requirements of supported equipment.
3. Pad Material: Oil and water resistant with elastomeric properties.
4. Surface Pattern: Ribbed pattern.
5. Load-bearing metal plates adhered to pads.

C. Double-Deflection, Elastomeric Isolation Mounts M1:

1. Mounting Plates:

   a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded, or with threaded studs or bolts.
   b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

D. Restrained Elastomeric Isolation Mounts M2:

1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

   a. Housing: Cast-ductile iron or welded steel.
   b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

E. Spring Isolators S1: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators S2: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and

leveling bolt that acts as blocking during installation. Baseplates shall limit floor load to 500 psig.

2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Restrained Spring Isolators S3: Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

   a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.

   b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric pad: For high frequency absorption at the base of the spring.

H. Elastomeric Hangers H1:

1. Description: Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods

   a. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
   b. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

I. Spring Hangers H2: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Description: Combination Coil-Spring and Elastomeric-Insert Hanger with spring and Insert in Compression.

   a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a

maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
g. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

J. Spring Hangers with Vertical-Limit Stop H3: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Description: Combination Coil-Spring and Elastomeric-Insert Hanger with spring and insert in Compression and vertical limit stop.

a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
g. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
h. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. Pipe Riser Resilient Support R1:

1. Description: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch-thick neoprene.

a. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
b. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

L. Resilient Pipe Guides R2:

1. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.

a. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of

motion to meet location requirements.

M. Horizontal Thrust Restraints T1: Modified specification S2 isolator.

1. Horizontal thrust restraints shall consist of a modified specification S2 spring mounting. Restraint springs shall have the same deflection as the isolator springs.
2. The assembly shall be preset at the factory and fine tuned in the field to allow for a maximum of 1/4" movement from stop to maximum thrust.
3. The assemblies shall be furnished with rod and angle brackets for attachment to both the equipment and duct work or the equipment and the structure.
4. Restraints shall be attached at the center line of thrust and symmetrically on both sides of the unit.

2.2 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. CalDyn (California Dynamics Corporation).
3. ISAT (International Seismic Application Technology).
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibro-Acoustics
7. VMC (Vibration Mountings & Controls, Inc.)

B. Restrained Vibration Isolation Roof-Curb Rails: RC1:

C. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.

D. Upper Frame: The upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic forces.

E. Lower Support Assembly: The lower support assembly shall be a formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

F. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch-thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic and wind restraint.

a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the

spring at rated load.

c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch-thick.

H. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. CalDyn (California Dynamics Corporation).
3. ISAT (International Seismic Application Technology).
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibro-Acoustics
7. VMC (Vibration Mountings & Controls, Inc.)

B. Steel Bases and Rails SB1: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

   a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Inertia Base IB1: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than [1-inch] 2-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

   a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors

in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. CalDyn (California Dynamics Corporation).
3. ISAT (International Seismic Application Technology).
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibro-Acoustics
7. VMC (Vibration Mountings & Controls, Inc.)

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

D. Channel Support System: MFMA-4, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement. Cables located in exterior or other wet locations such as wash-down areas shall be stainless steel.

F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.

G. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

H. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

I. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements

and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

J. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

K. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

L. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

M. All post installed anchors utilized in the seismic design must be qualified for use in cracked concrete and approved for use with seismic loads.

N. Expansion anchors shall not be used for anchorage of equipment with motors rated over 10 HP with the exception of undercut expansion anchors. Spring or internally isolated equipment are exempt from this requirement.

O. All beam clamps utilized for vertical support must also incorporate retention straps.

P. All seismic brace arm anchorages to include concrete anchors, beam clamps, truss connections, etc., must be approved for use with seismic loads.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before

installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Divison 03 Section "Cast-in-Place Concrete."

B. Coordinate size, shape, reinforcement and attachment of all housekeeping pads supporting vibration/seismically rated equipment. Concrete shall have a minimum compressive strength of 4,000 psi or as specified by the project engineer. Coordinate size, thickness, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and seismic restraint device manufacturer to ensure adequate space, embedment and prevent edge breakout failures. Pads and piers must be adequately doweled in to structural slab.

C. Housekeeping pads shall have adequate space to mount equipment and seismic restraint devices.

D. Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors and shall also be large enough and thick enough to ensure adequate edge distance and embedment depth for restraint anchor bolts to avoid housekeeping pad breakout failure. Refer seismic restraint manufacturer’s written instructions.

E. Coordinate with vibration/seismic restraint manufacturer and the structural engineer of record to locate and size structural supports underneath vibration/seismically restrained equipment (e.g. roof curbs, cooling towers and other similar equipment). Installation of all seismic restraint materials specified in this section shall be accomplished as per the manufacturer’s written instructions. Adjust isolators and restraints after piping systems have been filled and equipment is at its operating weight, following the manufacturer’s written instructions.

3.3 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES and per the seismic restraint manufacturer’s design.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.4 VIBRATION-CONTROL DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.

C. Isolate all mechanical equipment 0.75 hp and over per the isolator and seismic restraint schedule and these specifications. Vibration isolators shall be selected in accordance with the equipment, pipe or duct weight distribution so as to produce reasonably uniform deflections

D. All isolation materials and seismic restraints shall be of the same vendor and shall be selected and certified using published or factory certified data

E. Installation of all vibration isolation materials, flexible connectors and supplemental equipment bases specified in this section shall be accomplished as per the manufacturer's written instructions with mountings adjusted to level equipment. Any variance or non-compliance with the manufacturer's instructions shall be reviewed and approved in writing by the manufacturer or corrected by the contractor in an approved manner.

F. Installation of vibration isolators must not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.

G. Locate isolation hangers as near to the overhead support structure as possible.

H. No rigid connections between isolated components and the building structure shall be made that degrades the noise and vibration control system herein specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls. "Components" includes, but is not limited to, mechanical equipment, piping and ducts.

I. Coordinate work with other trades to avoid rigid contact with the building.

J. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.

K. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractor's expense.

L. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractor's expense.

M. Use horizontal thrust restraints T1 to protect Air handling equipment and centrifugal fans against excessive displacement which results from high air thrust when thrust forces exceed 10% of the equipment weight.

N. Isolated equipment, duct and piping located on roofs must be attached to the structure. Supports (e.g., sleepers) that are not attached to the structure will not be acceptable.

O. On completion of installation of all isolation materials and before startup of isolated equipment all debris shall be cleared from areas surrounding and from beneath all isolated equipment, leaving equipment free to move on the isolation supports.

P. All floor mounted isolated equipment shall be protected with specification M1, M2, S1, S2 or S3 isolator.

Q. Horizontal Pipe Isolation: All HVAC pumped water, pumped condensate, glycol, and refrigerant piping size 1-1/4” and larger within mechanical rooms shall be isolated. Outside equipment rooms this piping shall be isolated for the greater of 50’ or 100 pipe diameters from rotating equipment. For the first three (3) support locations from externally isolated equipment provide specification H2 or H3 hangers or specification S1, S2 or S3 mounts with the same deflection as equipment isolators (max 2”). All other piping within the equipment rooms shall be isolated with the same specification isolators with a 3/4” minimum deflection. Steam piping size 1-1/4” and larger which is within an equipment room and connected to rotating equipment shall be isolated for three (3) support locations from the equipment. Provide specification H2 or H3 hangers, or specification S1 or S2 mounts with the same deflection as equipment isolators but a minimum of ¾”.

R. Install full line size flexible pipe connectors at the inlet and outlet of each pump, cooling tower, condenser, chiller, coiling connections and where shown on the drawings. All connectors shall be suitable for use at the temperature, pressure, and service encountered at the point of installation and operation. End fitting connectors shall conform to the pipefitting schedule. Control rods or protective braid must be used to limit elongation to 3/8”. Flexible connectors shall not be required for suspended in-line pumps.

S. All plumbing pumped water, piping size 1-1/4” and larger within mechanical rooms shall be isolated the same as HVAC piping above. Isolators are not required for any plumbing pumped water, pumped condensate, and steam piping outside of mechanical rooms unless listed in the isolation schedule.

T. Pipe Riser Isolation: The operating weight of all variable temperature vertical pipe risers 1-1/4” and larger, requiring isolation where specifically shown and detailed on riser drawings shall be fully supported by specification M1, M2 or R1 supports. S1, S2, S3, H2 or H3 steel spring deflection isolators with minimum 3/4-inch minimum shall be in those locations where added deflection is required due to pipe expansion and contraction. Spring deflection shall be a minimum of 4 times the anticipated deflection change. Springs shall be selected to keep the riser in tension. Height saving brackets used with isolators having 2.5" deflection or greater shall be of the precompression type to limit exposed bolt length. Specification R1 riser supports shall be installed near the center point of the riser to anchor the riser when spring isolation is used. Specification R2 riser guides may be used in conjunction with spring isolators per design calculations. Pipe risers up through 16” shall be supported at intervals of every third floor of the building. Pipe risers 18” and over, every second floor. Wall sleeves for take-offs from riser shall be sized for insulation O.D. plus two times the anticipated movement to prevent binding. Horizontal take-offs and at upper and lower elbows shall be supported with spring isolators as required to accommodate anticipated movement. In addition to submittal data requirements previously outlined, riser diagrams and calculations shall be submitted for approval. Calculations must show anticipated expansion and contraction at each support point, initial and final loads on the building structure, and spring deflection changes. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist if installed per design proposed.

U. Where riser pipes pass through cored holes, core diameters shall be a maximum of 2” larger than pipe O.D. including insulation. Cored holes must be packed with resilient material or firestop as provided by other sections of this specification or local codes. Where seismic restraint is required specification isolator S3 shall support risers and provide longitudinal restraint at floors where thermal expansion is minimal and will not bind isolator restraints.

V. Duct Isolation: Isolate all duct work with a static pressure 2” W.C. and over in equipment rooms and to minimum of 50 feet from the fan or air handler. Use specification type H2 or H3 hangers or type S1 or S2 floor mounts.

3.5 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. On projects with Seismic Site Class A or B, seismic design or restraint is not required.
2. On projects with Seismic Design Category C: Components with an importance factor of 1.0 do not require seismic design or restraint.
3. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
4. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
5. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
6. Suspended Equipment: All suspended equipment that meets any of the following conditions requires seismic restraints as specified by the supplier:

    a. Rigidly attached to pipe or duct that is 75 lbs. and greater,
    b. Items greater than 20 lbs and distribution systems weighing more than 5 lbs/lineal foot, with an importance factor of 1.0 hung independently or with flexible connections.
    c. Possibility of consequential damage.
    d. For importance factors greater than 1.0 all suspended equipment requires seismic restraint regardless of the above notes.
    e. Wall mounted equipment weighing more than 20 lbs.
    f. Exemptions:

        1) Equipment weighing less than 20 lbs and distribution systems weighing less than 5 lbs/lineal foot, with an Ip = 1.0 and where flexible connections exist between the component and associated ductwork, piping or conduit.

7. Base Mounted Equipment: All base mounted equipment that meets any of the following conditions requires attachments and seismic restraints as specified by the supplier:

    a. Connections to or containing hazardous material,
    b. With an overturning moment.
    c. Weight greater than 400 lbs.
    d. Mounted on a stand 4 ft. or more from the floor
    e. Possibility of consequential damage.
    f. For importance factors greater than 1.0 all base mounted items require seismic restraints regardless of the above notes.
    g. For equipment with high center of gravity additional cable restraints shall be furnished, as required by isolation manufacturer, to limit forces and motion caused by rocking.
    h. Exemptions:

        1) Floor or curb-mounted equipment weighing less than 400 lbs and not resiliently mounted, where the Importance Factor, Ip = 1.0, the components are mounted at 4 feet or less above a floor level, flexible connections between the components and associated duct work, piping and conduit are provided and there is no possibility of consequential damage.

8. Roof Mounted Equipment:

    a. To be installed on a structural frame, seismically rated roof curb, or structural curb frame mechanically connected to the structure. Items shall not be mounted onto sleepers or pads that are not mechanically and rigidly attached to the structure. Restraint must be adequate to resist both seismic and wind forces.
    b. Roof curbs shall be installed directly to building structural steel or concrete roof deck and not to top of steel deck or roofing material.
    c. Exemptions:

        1) Curb-mounted mushroom, exhaust and vent fans with curb area less than nine square feet are excluded.

9. Rigid Mounted Equipment:

    a. Anchor floor and wall mounted equipment to the structure as per the stamped seismic certifications / drawings.
    b. For equipment with high center of gravity additional cable restraints shall be furnished, as required by isolation manufacturer, to limit forces and motion caused by rocking.
    c. Suspended equipment shall be restrained using seismic cable restraints, or struts, and hanger rods as per the stamped seismic certifications / drawings.

10. Vibration Isolated Equipment:

    a. Seismic control shall not compromise the performance of noise control, vibration isolation or fire stopping systems.
    b. Equipment supported by vibration-isolation hangers shall be detailed and installed with approximately a 1/8” gap between the isolation hangers and the structure. Isolators at restraint locations must be fitted with uplift limit stops.

B. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

C. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

D. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

E. Installation and adjustment of all seismic restraints specified in this section shall be accomplished as per the manufacturer’s written instructions. Any deviation from the manufacturer’s instructions shall be reviewed and approved by the manufacturer.

F. Piping Restraints:

    1. Comply with requirements in MSS SP-127.
    2. Seismically restrain piping, with an Ip = 1.0, located in boiler rooms, mechanical equipment rooms and refrigeration equipment rooms that is 1¼” I.D. and larger.
    3. Seismically restrain all other Ip = 1.0 piping 2½” diameter and larger.
    4. Seismically restrain all Ip = 1.5 piping larger than 1” diameter.
    5. Branch lines may not be used to brace main lines.

6. Exemptions:
   a. All high deformability pipe 3” or less in diameter suspended by individual hanger rods where Ip = 1.0.
   b. High deformability pipe or conduit in Seismic Design Category C, 2” or less in diameter suspended by individual hanger rods where Ip = 1.5.
   c. High deformability pipe in Seismic Design Category D, E or F, 1” or less in diameter suspended by individual hanger rods where Ip = 1.5.
   d. All clevis supported pipe runs installed less than 12” from the top of the pipe to the underside of the support point and trapeze supported pipe suspended by hanger rods having a distance less than 12” in length from the underside of the pipe support to the support point of the structure.
   e. Piping systems, including their supports, designed and constructed in accordance with ASME B31.
   f. Piping systems, including their supports, designed and constructed in accordance with NFPA, provided they meet the force and displacement requirements of Section 13.3.1 and 13.3.2 (ASCE 7).

G. Install flexible metal hose loops in piping which crosses building seismic joints, sized for the anticipated amount of movement.

H. Install flexible piping connectors where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

I. Where pipe sizes reduce below dimensions required for seismic, the final restraint shall be installed at the transition location.

J. Restraint Spacing For Piping: Sizes shown are maximum. Actual spacing determined by calculation.

   1. For non-ductile piping (e.g., cast iron, PVC) space transverse supports a maximum of 20’ o.c., and longitudinal supports a maximum of 40’ o.c.
   2. For piping with hazardous material inside (e.g., natural gas, medical gas) space Transverse supports a maximum of 20’ o.c., and longitudinal supports a maximum of 40’ o.c.
   3. For pipe risers, restrain the piping at floor penetrations using the same spacing requirements as above.
   4. For all other ductile piping see Table “A” below

K. Seismic Restraint of Ductwork: Seismically restrain per specific code requirements, all ductwork listed below (unless otherwise indicated on the drawings), using seismic cable restraints:
   (Ductwork not meeting criteria listed below is to be “Exempt”)

   1. Restrain rectangular ductwork with cross sectional area of 6 square feet or larger. Duct with and an importance factor of 1.5 must be braced with no exceptions regardless of size or distance requirements.
   2. Restrain round ducts with diameters of 28” or larger. Duct with an importance factor of 1.5 must be braced with no exceptions regardless of size or distance requirements.
   3. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
   4. Duct must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze. Additional reinforcing is

not required if duct sections are mechanically fastened together with frame bolts and positively fastened to the duct support suspension system.

5. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.

6. Walls, including gypsum board non-bearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.
7. If ducts are supported by angles, channels or struts, ducts shall be fastened to it at seismic brace locations in lieu of duct reinforcement.
8. All ductwork weighing more than 17 lb/ft.
9. Exemptions:

    a. Duct runs supported at locations by two rods less than 12 inches in length from the structural support to the structural connection to the ductwork. This exemption does not apply to ducts with an importance factor of 1.5.

10. See Table “A” below for restraint spacing.

L. Exemptions do not apply for:

1. Life Safety or High Hazard Components

    a. Including gas, fire protection, medical gas, fuel oil and compressed air needed for the continued operation of the facility or whose failure could impair the facility’s continued operation, Occupancy Category IV, IBC-2015 as listed in Section 1.3 B regardless of governing code for HVAC, Plumbing, Electrical piping or equipment. (A partial list is illustrated.) High Hazard is additionally classified as any system handling flammable, combustible or toxic material. Typical systems not excluded are additionally listed below.

2. Piping

    a. Fuel oil, gasoline, natural gas, medical gas, steam, compressed air or any piping containing hazardous, flammable, combustible, toxic or corrosive materials. Fire protection standpipe, risers and mains. Fire Sprinkler Branch Lines must be end tied.

3. Duct

    a. Smoke evacuation duct or fresh air make up connected to emergency system, emergency generator exhaust, boiler breeching or as used by the fire department on manual override.

4. Equipment

    a. Previously excluded non life safety duct mounted systems such as fans, variable air volume boxes, heat exchangers and humidifiers having a weight greater than 75 lbs require independent seismic bracing.

M. Spacing Chart For Suspended Components:

N. Roof mounted duct is to be installed on sleepers or frames mechanically connected to the building

Table “A” Seismic Bracing (Maximum Allowable Spacing Shown- Actual Spacing to Be Determined by Calculation)			
Equipment	On Center Transverse	On Center Longitudinal	Change Of Direction
Duct			
All Sizes	30 Feet	60 Feet	4 Feet
Pipe Threaded, Welded, Soldered Or Grooved			
To 16”	40 Feet	80 Feet	4 Feet
18” – 28”	30 Feet	60 Feet	4 Feet
30” – 40”	20 Feet	60 Feet	4 Feet
42” & Larger	10 Feet	30 Feet	4 Feet

structure. Roof anchors and seismic cables or frames shall be used to resist seismic and wind loading. Wind loading factors shall be determined by the registered design professional.

O. Where duct sizes reduce below dimensions required for seismic restraint the final restraint shall be installed at the transition location.

P. Install cables so they do not bend across edges of adjacent equipment or building structure.

Q. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

R. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

S. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

T. Seismically Rated Beam Clamps are required where welding to or penetrations to steel beams are not approved.

U. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications

conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.6 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.

3.7 FIELD QUFALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

1. A representative of the vibration isolation system manufacturer shall review the project installation and provide documentation indicating conformance to vibration isolation design intent

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

1. The installing contractor shall submit a report upon request to the building architect and/or engineer, including the manufacturer’s representative’s final report, indicating that all seismic restraint material has been properly installed, or steps that are to be taken by the contractor to properly complete the seismic restraint work as per the specifications.

3.8 IDENTIFICATION

A. Install identification tags at all seismic brace locations. Tags to include the following information:

1. Specific seismic forces (g-force) the location was designed to resist.
2. Maximum brace reaction at connection to structure.
3. For single hung items, the maximum pipe/conduit size the brace location was designed to accommodate.
4. For trapeze supported items, the maximum weight (lbs/lf) the brace location was designed

to accommodate.

5. For suspended equipment, the maximum unit operating weight (lbs) the brace location was designed to accommodate.
6. Location identifier cross matched to that on plan set layout.
7. Company name of installing contractor.

3.9 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust leveling devices as required to distribute loading uniformly on isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.

1. Adjust active height of spring isolators.

C. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

EQUIPMENT ISOLATION SCHEDULE									
LOCATION	A' CRITICAL (35'-50' SPAN)			B' UPPER STORY (20'-35' SPAN)			C' GRADE		
EQUIPMENT (1)	ISOLATOR TYPE	MINIMUM DEFLECTION (IN)	BASE TYPE	ISOLATOR TYPE	MINIMUM DEFLECTION (IN)	BASE TYPE	ISOLATOR TYPE	MINIMUM DEFLECTION (IN)	BASE TYPE
AIR HANDLING UNITS									
FLOOR MOUNTED									
UP TO 15 HP	S3	1.5		S3	0.75		S3	0.75	
20 HP & OVER	S3	2.5	SB1	S3	1.5		S3	0.75	
SUSPENDED									

UP TO 15 HP	H3	1.75		H3	1		H3	1	
20 HP & OVER	H3	2.5	SB1	H3	1.75		H3	1	
HIGH PRESSURE FAN SECTIONS									
UP TO 30 HP	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	IB1
40 HP & OVER	S1	3.5	IB1	S3	2.5	IB1	S3	1.5	IB1
CENTRIFUGAL FANS									
CL. I & II UP TO *54-112"* W.D.									
UPT015HP	S3	1.5	SB1	S3	0.75	SB1	S3	0.75	SB1
20-50 HP	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	SB1
60 HP & OVER	S1	3.5	IB1	S1	2.5	IB1	S3	1.5	SB1
CL. I & II 60" W.D. & OVERI ALL CL. III FANS									
UPT015HP	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	IB1
20-50 H P	S1	2.5	IB1	S1	2.5	IB1	S3	1.5	IB1
60 HP & OVER	S1	3.5	IB1	S1	2.5	IB1	S3	1.5	IB1
AXIAL FLOWFANS									
FLOOR MTD.									
UP TO 15 HP	S3	1.5	SB1	S3	0.75		S3	0.75	
20 HP & OVER	S1	3.5	IB1	S3	1.5		S3	0.75	
SUSPENDED									
UP TO 15 HP	H3	1.75	SB1	H3	1		H3	1	
20 HP & OVER	H3	2.5	SB1	H3	1.75	SB1	H3	1.5	
VENT (UTILITY SETS)									
FLOOR MTD	S3	1.5	SB1	S3	0.75		S3	0.75	
SUSPENDED	H3	1.75	SB1	H3	1		H3	0.75	

CABINET FANS, FANS SECTIONS									
FLOOR MTD.									
UP TO 15 HP	S3	1.5		S3	0.75		S3	0.75	
20 HP & OVER	S1	2.5	IB1	S3	1.5		S3	0.75	
SUSPENDED									
UP TO 15 HP	H3	1.75		H3	1		H3	0.75	
20 HP & OVER	H3	2.5	SB1	H3	1.75		H3	1.75	
PUMPS									
FLOOR MTD.									
UP TO 15 HP	S3	0.75	IB1	S3	0.75	IB1	SRVD	0.4	IB1
7-112 HP & OVER	S3	1.5	IB1	S3	1.5	IB1	S3	0.75	IB1
SUSPENDED INLINE	H3	1.75		H3	1.75		H3	1	
REFRIGERATION UNITS									
RECIPROCATING COMPRESSORS	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	IB1
RECIPROCATING COND. UNITS & CHILLERS	S1	2.5	IB1	S3	1.5		S3	0.75	
HERMETIC CENTRIFUGALS	S3	2.5		S3	1.5		P1	0.15	
OPEN CENTRIFUGALS	S1	2.5	IB1	S3	1.5	IB1	P1	0.15	
ABSORPTION MACHINES	S3	1.5		S3	0.75		P1	0.15	
AIR COMPRESSORS									
TANK TYPE (HORIZONTAL TANK)	S1	2.5	IB1	S3	1.5		S3	0.75	
TANK TYPE (VERTICAL TANK)	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	
AIR COOLED CONDENSERS									

UP TO 50 TONS	S3	1.5		S3	0.75		P1	0.15	
OVER 50 TONS	S3	2.5		S3	1.5		P1	0.15	
ROOFTOP AIR CONDITIONING UNITS									
REQUIRING WEATHER SEAL									
UP TO 5000 CFM (12 TON)	S1	1.5	RC1	S1	0.75	RC1			
OVER 5000 CFM (12 TON)	S3	2.5	RC1	S3	1.5	RC1			
OTHER TYPES									
UP TO 25 TONS	S3	1.5		S3	1.5				
OVER 25 TONS	S3	2.5		S3	1.5				
BOILER (PACKAGE TYPE)									
ALL SIZES	S3	1.5		S3	0.75		P1	0.15	
ENGINE DRIVEN GENERATORS									
UP TO 60 HP	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	
75 HP & OVER	S1	3.5	IB1	S3	2.5	IB1	S3	0.75	

NOTES:

1) Thrust restraints required on all high-pressure fan section, suspended axial-flow fans and on floor-mounted axial fans operating at 3.0” S.P. or greater.

END OF SECTION 230578

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230550

OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All pertinent sections of Division 21, 22, & 23 Mechanical General Requirements, are part of the work of this Section. Division 1 is part of this and all other sections of these specifications.

1. Testing and Balancing is specified in section 230594.
2. Training and Instructions to Owner's Representative is specified in section 230100.

1.2 SCOPE OF WORK

A. Submission of Operating and Maintenance Manuals complete with Balancing reports. (Coordinate with Division 1).

B. Coordination of work required for system commissioning.

C. Provide a hard copy and an electronic copy on CD of the O and M manual fully searchable in PDF format.

1.3 SUBMITTALS

A. Submit product data in accordance with Division 1 and Section 230100. Submit the following:

1. Sample of O and M manual outline.

PART 2 - PRODUCTS

2.1 O & M MANUALS

A. The operating and maintenance manuals shall be as follows:

1. Binders shall be red buckram with easy-view metal for size 8-1/2 x 11-inch sheets, with capacity expandable from 2 inches to 3-1/2 inches as required for the project. Construction shall be rivet-through with library corners. No. 12 backbone and lining shall be the same material as the cover. The front cover and backbone shall be foil-stamped in white as follows: (coordinate with Division 01)

OPERATING AND MAINTENANCE
MANUAL
FOR THE

PART 3 - EXECUTION

3.1 OPERATING AND MAINTENANCE MANUALS:

A. Work under this section shall be performed in concert with the contractor performing the system testing and balancing. Six (6) copies of the manuals shall be furnished to the Architect for distribution to the owner.

B. The "Start-Up and Operation" section is one of the most important in the manual. Information in this section shall be complete and accurately written and shall be verified with the actual equipment on the job, such as switches, starters, relays, automatic controls, etc. A step-by-step start-up procedure shall be described.

C. The manuals shall include air and water-balancing reports, system commissioning procedures, start-up tests and reports, equipment and system performance test reports, warranties, and certificates of training given to the owner's representatives.

D. An index sheet typed on AICO Gold-Line indexes shall be provided in the front of the binder. The manual shall be include the following:

1. SYSTEM DESCRIPTIONS
2. START-UP PROCEDURE AND OPERATION OF SYSTEM
3. MAINTENANCE AND LUBRICATION TABLE
4. OPERATION AND MAINTENANCE BULLETINS
5. AUTOMATIC TEMPERATURE CONTROL DESCRIPTION OF OPERATION, INTERLOCK AND CONTROL DIAGRAMS, AND CONTROL PANELS.
6. AIR AND WATER SYSTEM BALANCING REPORTS
7. EQUIPMENT WARRANTIES AND TRAINING CERTIFICATES
8. SYSTEM COMMISSIONING REPORTS
9. EQUIPMENT START-UP CERTIFICATES

END OF SECTION 230550

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Danger, Warning and Caution signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Danger tags.
8. Warning tags.
9. Caution tags.
10. Ceiling grid

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Minimum Thickness, predrilled or stamped holes for attachment hardware:

a. Brass, 0.032-inch .

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel;

a. Rivets or self-tapping screws

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, and having predrilled holes for attachment hardware, 1/16 inch thick.
2. Letter Color:

a. Black.

3. Background Color:

a. White.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel;

a. Rivets or self-tapping screws

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where

equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 DANGER, WARNING AND CAUTION SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, having predrilled holes for attachment hardware; 1/16 inch thick.

B. Danger signs, colors:

1. Letter Color:

a. White.

2. Background Color:

a. Red.

C. Warning signs, colors:

1. Letter Color:

a. Black.

2. Background Color:

a. Orange.

D. Caution signs, colors:

1. Letter Color:

a. Black.

2. Background Color:

a. Yellow.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

H. Fasteners: Stainless-steel;

1. Rivets or self-tapping screws

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 incheshigh.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, having predrilled holes for attachment hardware; 1/16 inch thick.

B. Letter Color:

1. Black.

C. Background Color:

1. Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel;

1. Rivets or self-tapping screws

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both

directions, or as separate unit on each duct label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material:

a. Aluminum.

2. Stencil Paint:

a. Exterior, gloss, alkyd enamel black unless otherwise indicated.

b. Paint may be in pressurized spray-can form.

3. Identification Paint:

a. Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material, predrilled or stamped holes for attachment hardware, minimum thickness:

a. Brass, 0.032-inch

2. Fasteners: Brass;

a. Wire-link or beaded chain; or S-hook

B. Valve Schedules:

1. For each piping system, on 8-1/2-by-11-inch bond paper, tabulate;

a. Valve number.
b. Piping system.
c. System abbreviation (as shown on valve tag).
d. Location of valve (room or space).
e. Normal-operating position (open, closed, or modulating).
f. Variations for identification.
g. Mark valves for emergency shutoff and similar special uses.

2. Valve-tag schedule:

a. Shall be included in operation and maintenance data.

2.7 DANGER TAGS

A. Danger Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size:

a. 3 by 5-1/4 inches minimum

2. Fasteners:

a. Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," and "DO NOT OPERATE."
4. Color: Red background with white lettering.

2.8 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size:

a. 3 by 5-1/4 inches minimum

2. Fasteners:

a. Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as “WARNING” and "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

2.9 CAUTION TAGS

A. Caution Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size:

a. 3 by 5-1/4 inches minimum

2. Fasteners:

a. Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "CAUTION," and "DO NOT OPERATE."

4. Color: Orange background with black lettering.

2.10 CEILING GRID

A. Provide red lettering on the ceiling tile grid of the locations of all fire dampers, smoke dampers and fire/smoke dampers. Size of lettering and verbiage is to conform to IBC and NFPA standards.

B. Provide valve identification for all HVAC valves located above the ceiling on the ceiling grid below the valve.

C. Provide VAV box identification for all VAV boxes located above the ceiling on the ceiling grid below the VAV box.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09.

B. Stenciled Pipe Label Option:

1. Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option.
2. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.

a. Identification Paint: Use for contrasting background.

b. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule: (See Drawing Schedules)

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue : For cold-air supply ducts.
2. Yellow : For hot-air supply ducts.
3. Green : For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION (See Drawing Schedules.)

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

   a. Constant-volume air systems.
   b. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:

   a. Constant-flow hydronic systems.
   b. Variable-flow hydronic systems.
   c. Primary-secondary hydronic systems.

3. Various HVAC Equipment.

   a. Heat Exchangers.
   b. Motors.
   c. Chillers.
   d. Condensing Units.
   e. Boilers.
   f. Heat Transfer Coils.

4. Domestic Heater Systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 ACTION SUBMITTALS

A. LEED Submittals:

1. Air-Balance Report for Prerequisite IEQ 1: Documentation of work performed for ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

2. TAB Report for Prerequisite EA 2: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within the following number of days of the Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article;

1. 30 days.

B. Certified TAB reports.

C. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB and shall be the same as the TAB Contractor.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician and shall be the same as the TAB Contractor.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by:

1. Architect.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.8 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on the following distribution systems have been satisfactorily completed:

1. Air and water.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:

1. BTC Service.
2. Certified Test & Balance.
3. RS Analysis.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer

wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine:

1. Ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in:

   a. Section 233113 "Metal Ducts"

2. Verify ceiling plenums and underfloor air plenums used for supply, return or relief air are properly separated from adjacent areas.
3. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in this section and:

1. AABC's "National Standards for Total System Balance"
2. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) .

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

   a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

   a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from one of the following entities for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance:

    a. Architect.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance variable-air-volume systems the same as described for constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
6. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
3. Set terminal units at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal

valves are kept open.

6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.9 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from the following entity and comply with requirements in Section 232123 "Hydronic Pumps.”:

1) Architect.

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presettings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.11 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

A. Balance the primary circuit flow first and then balance the secondary circuits.

3.12 PROCEDURES FOR HEAT EXCHANGERS

A. Measure water flow through all circuits.

B. Adjust water flow to within specified tolerances.

C. Measure inlet and outlet water temperatures.

D. Measure inlet steam pressure.

E. Check settings and operation of safety and relief valves. Record settings.

3.13 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.

4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.14 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
6. Capacity: Calculate in tons of cooling.
7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.15 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.16 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.

2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.17 DOMESTIC HEATER SYSTEMS

A. Test domestic heater system per Engineer’s instructions.

3.18 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent .
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.19 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare progress reports on the following interval to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and

problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors;

1. Weekly.

3.20 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:

a. Indicated versus final performance.
b. Notable characteristics of systems.
c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.

14. Notes to explain why certain final data in the body of reports vary from indicated values.

15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

    1. Quantities of outdoor, supply, return, and exhaust airflows.
    2. Water and steam flow rates.
    3. Duct, outlet, and inlet sizes.
    4. Pipe and valve sizes and locations.
    5. Terminal units.
    6. Balancing stations.
    7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

    1. Unit Data:

        a. Unit identification.
        b. Location.
        c. Make and type.
        d. Model number and unit size.
        e. Manufacturer's serial number.
        f. Unit arrangement and class.
        g. Discharge arrangement.
        h. Sheave make, size in inches, and bore.
        i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
        j. Number, make, and size of belts.
        k. Number, type, and size of filters.

    2. Motor Data:

        a. Motor make, and frame type and size.
        b. Horsepower and rpm.
        c. Volts, phase, and hertz.
        d. Full-load amperage and service factor.
        e. Sheave make, size in inches, and bore.
        f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

    3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Fuel type in input data.
    g. Output capacity in Btu/h.
    h. Ignition type.
    i. Burner-control types.
    j. Motor horsepower and rpm.
    k. Motor volts, phase, and hertz.
    l. Motor full-load amperage and service factor.
    m. Sheave make, size in inches, and bore.
    n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

    a. Total air flow rate in cfm.
    b. Entering-air temperature in deg F.
    c. Leaving-air temperature in deg F.
    d. Air temperature differential in deg F.
    e. Entering-air static pressure in inches wg.
    f. Leaving-air static pressure in inches wg.
    g. Air static-pressure differential in inches wg.
    h. Low-fire fuel input in Btu/h.
    i. High-fire fuel input in Btu/h.
    j. Manifold pressure in psig.
    k. High-temperature-limit setting in deg F.
    l. Operating set point in Btu/h.
    m. Motor voltage at each connection.
    n. Motor amperage for each phase.
    o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches, and bore.
    h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.

e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.

p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.21 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.

b. Measure water flow of at least 5 percent of terminals.

c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.

d. Verify that balancing devices are marked with final balance position.

e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that

testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by:

a. Architect.

2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of:

a. Architect.

3. The following entity shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day:

a. Architect.

4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.22 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713

DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Outdoor, concealed supply and return.
6. Outdoor, exposed supply and return.

B. Related Sections:

1. Section 230716 "HVAC Equipment Insulation."
2. Section 230719 "HVAC Piping Insulation."
3. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.

3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.

b. Armacell LLC; AP Armaflex.

c. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armacell LLC; Tubolit.
b. Nomaco Insulation; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a:

a. 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction

1. Products: Subject to compliance with requirements, provide the following :

a. Johns Manville; Super Firetemp M.

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a:

a. 2-hour fire rating by an NRTL acceptable to authorities

2. 1. Products: Subject to compliance with requirements, provide one of the following :

a. CertainTeed Corp.; FlameChek.
b. Johns Manville; Firetemp Wrap.
c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
d. Thermal Ceramics; FireMaster Duct Wrap.
e. 3M; Fire Barrier Wrap Products.
f. Unifrax Corporation; FyreWrap.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Aeroflex USA, Inc.; Aeroseal.
   b. Armacell LLC; Armaflex 520 Adhesive.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
   d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. FSK Jacket Adhesive, and ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.

4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
   b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
   c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

   a. Sheet and roll stock ready for shop or field sizing
   b. Finish and thickness are indicated in field-applied jacket schedules.

c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft.

2.9 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.

4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal.

3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CHP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.

   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, provide one of the following:

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
2) GEMCO; Peel & Press.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at:

   a. 2 inche o.c.
   b. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for:

   a. 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Impale insulation over pins and attach speed washers.
   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for:

   a. 50 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Testing Agency:

a. Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location (s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Outdoor, concealed supply and return.
6. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.12 Insulation shall have an R value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

3.13 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

C. Concealed, round and flat-oval, outdoor-air and combustion-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

D. Concealed, round and flat-oval, exhaust-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

E. Concealed, rectangular, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

F. Concealed, rectangular, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. **Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.**

G. Concealed, rectangular, outdoor-air and combustion-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

H. Concealed, supply-air plenum insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

I. Concealed, return-air plenum insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

J. Concealed, outdoor-air plenum insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

K. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

L. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.

M. Exposed, round and flat-oval, outdoor-air and combustion-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

N. Exposed, rectangular, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

O. Exposed, rectangular, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. **Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.**

P. Exposed, rectangular, outdoor-air and combustion-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

Q. Exposed, supply-air plenum insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

R. Exposed, return-air plenum insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

3.14 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Polyolefin: 1 inch thick.

C. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Polyolefin: 1 inch thick.

D. Exposed, rectangular, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Polyolefin: 1 inch thick.

E. Exposed, rectangular, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Polyolefin: 1 inch thick.

F. Exposed, supply-air plenum insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Polyolefin: 1 inch thick.

G. Exposed, return-air plenum insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Polyolefin: 1 inch thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. Aluminum, Corrugated: 0.032 inch thick.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Corrugated: 0.032 inch thick.

E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Aluminum, with 1-1/4-Inch- Deep Corrugations: 0.032 inch thick.

END OF SECTION 230713

SECTION 230716

HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following HVAC equipment that is not factory insulated:

1. Chillers.
2. Heat exchangers.
3. Converters.
4. Chilled-water pumps.
5. Heating, hot-water pumps.
6. Expansion/compression tanks.
7. Air separators.
8. Thermal storage tanks.
9. Piping system filtration unit housings.

B. Related Sections:

1. Section 230713 "Duct Insulation."
2. Section 230719 "HVAC Piping Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance, thickness, and jackets (both factory- and field-applied if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail removable insulation at equipment connections.
4. Detail application of field-applied jackets.
5. Detail application at linkages of control devices.
6. Detail field application for each equipment type.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Breeching Insulation Schedule" and "Equipment Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Calcium Silicate:

1. Products: Subject to compliance with requirements:

a. Provide the following :

1) Industrial Insulation Group (IIG); Thermo-12 Gold.

2. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

G. Mineral-Fiber Blanket Insulation:

1. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290;

a. Type II with factory-applied vinyl jacket.

2. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.

c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber Board Insulation:

1. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Provide insulation:

a. With factory-applied ASJ or with factory-applied FSK jacket.

2. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; CertaPro Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ or FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; CrimpWrap.
b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation.
d. Manson Insulation Inc.; AK Flex.
e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements:

a. Provide the following:

1) Ramco Insulation, Inc.; Super-Stik.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements:

a. Provide the following

1) Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.

1. Products: Subject to compliance with requirements, Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-97.
b. Eagle Bridges - Marathon Industries; 290.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-27.
d. Mon-Eco Industries, Inc.; 22-30.
e. Vimasco Corporation; 760.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2,

Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Dow Corning Corporation; 739, Dow Silicone.
   b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
   c. P.I.C. Plastics, Inc.; Welding Adhesive.
   d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Foster Brand, Specialty Construction Brands, Inc., a business of H .B. Fuller Company; 30-80/30-90.

b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. Eagle Bridges - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
b. Eagle Bridges - Marathon Industries; 570.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.

b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
c. Vimasco Corporation; 713 and 714.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements:

a. Provide the following:

1) Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic

Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

    a. Products: Subject to compliance with requirements:

        1) Provide the following:

            a) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

6. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

    a. <u>Products</u>: Subject to compliance with requirements:

        1) Provide the following:

            a) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

    a. Products: Subject to compliance with requirements:

        1) Provide the following:

            a) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

1. Products: Subject to compliance with requirements:

a. Provide the following:

1) Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.

3. Color: White:

4. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications:

1) 1-mil- thick, heat-bonded polyethylene and kraft paper.

d. Moisture Barrier for Outdoor Applications:

1) 3-mil- thick, heat-bonded polyethylene and kraft paper.

e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with:

1. Facing:

a. White aluminum-foil.

2. Products: Subject to compliance with requirements:

a. Provide the following:

1) Polyguard Products, Inc.; Alumaguard 60.

F. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements:

a. Provide the following:

1) Dow Chemical Company (The), Saran 540 Vapor Retarder Film.

G. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96 and with a flame-spread

index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements:

   a. Provide the following:

      1) Dow Chemical Company (The), Saran 560 Vapor Retarder Film.

H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

1. Products: Subject to compliance with requirements:

   a. Provide the following:

      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.

4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.

d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements:

a. Provide the following:

1) Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.

2. Width: 3 inches.
3. Film Thickness: 4 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements:

a. Provide the following:

1) Dow Chemical Company (The); Saran 560 Vapor Retarder Tape.

2. Width: 3 inches.
3. Film Thickness: 6 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel:

a. ASTM A 167 or ASTM A 240,
b. Type:

1) Grade 316.

c. 0.015 inch thick
d. Width:

1) 3/4 inch .

e. Seal:

1) Wing seal.

3. Aluminum: ASTM B 209, Temper H-14;

a. Alloy; 3003, 3005, 3105, or 5005;
b. 0.020 inch thick.
c. Width;

1) 3/4 inch.

d. Seal;

1) Wing seal.

4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins:

a. Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, length to suit depth of insulation indicated. Shank diameter;

1) 0.135-inch-.

b. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins:

a. Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer. Shank diameter;

1) 0.135-inch-.

b. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CHP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

c. Spindle: Fully annealed, 0.106-inch- diameter shank, length to suit depth of

insulation indicated. Material:

1) Copper- or zinc-coated, low-carbon steel.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

a. Products: Subject to compliance with requirements, provide one of the following:

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers, Series.
2) GEMCO; Peel & Press.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

c. Spindle: Fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated. Material;

1) Copper- or zinc-coated, low-carbon steel.

d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers:

a. Self-locking washers formed from 0.016-inch- thick sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter. Material:

1) Galvanized-steel sheet.

b. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

c. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers: Subject to compliance with requirements, provide one of the following:

1) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire:

1. Material;

a. 0.080-inch nickel-copper alloy.

1. Manufacturers: Subject to compliance with requirements:

a. Provide the following :

1) C & F Wire.

2.12 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240, Material Type:

1. Grade 316 .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at:

   a. 2 inches o.c.
   b. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt

joints.

O. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 Insulation shall have a k value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

3.5 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for the following coverage of tank and vessel surfaces;

   a. 100 percent.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

   a. Do not weld anchor pins to ASME-labeled pressure vessels.
   b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
   c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
   d. Do not overcompress insulation during installation.
   e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
   f. Impale insulation over anchor pins and attach speed washers.
   g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut

with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from:

   a. Mateiral;

      1) Galvanized steel

   b. Thickness; (minimum);

      1) 0.060 inch .

3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Boiler Breechings:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation material.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
3. On exposed applications without metal jacket, finish insulation surface with a skim coat of mineral-fiber, hydraulic-setting cement. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth. Thin finish coat to achieve smooth, uniform finish.

B. Installation on Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

C. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.8 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment that is not factory insulated.

C. Heat-exchanger (water-to-water for heating service) insulation shall be one of the following:

1. Calcium Silicate: 3 inches thick.
2. Cellular Glass: [3 inches] <Insert dimension> thick.
3. Mineral-Fiber Board:

a. Thickness; 2 inches .
b. Nominal Density:

1) 3-lb/cu. ft.
2) [2-lb/cu. ft.] [6-lb/cu. ft.]

4. Mineral-Fiber Pipe and Tank: 2 inches thick.

D. Steam-to-hot-water converter insulation shall be one of the following:

1. Calcium Silicate: 3 inches thick.
2. Mineral-Fiber Board:

a. Thickness; 2 inches .
b. Nominal Density:

1) 3-lb/cu. ft.

3. Mineral-Fiber Pipe and Tank: 2 inches thick.

E. Chilled-water pump insulation shall be one of the following:

1. Mineral-Fiber Board:

a. Thickness; 2 inches .
b. Nominal Density:

1) 3-lb/cu. ft.

2. Mineral-Fiber Blanket Insulation: 2 inches thick.

F. Boiler feedwater pump insulation shall be one of the following:

1. Calcium Silicate: 3 inches thick.

2. Mineral-Fiber Board:

a. Thickness; 2 inches .
b. Nominal Density:

1) 3-lb/cu. ft.

3. Mineral-Fiber Pipe and Tank: 2 inches thick.

G. Chilled-water expansion/compression tank insulation shall be one of the following:

1. Mineral-Fiber Board:

a. Thickness; 1 inches .
b. Nominal Density:

1) 3-lb/cu. ft.

2. Mineral-Fiber Pipe and Tank: 1 inch thick.
3. Calcium Silicate: 1-1/2 inches thick.

H. Heating-hot-water expansion/compression tank insulation shall be one of the following:

1. Calcium Silicate: 2 inches thick.
2. Mineral-Fiber Board:

   a. Thickness; 1 inches .
   b. Nominal Density:

      1) 3-lb/cu. ft.

3. Mineral-Fiber Pipe and Tank: 1 inch thick.

I. Heat-recovery expansion/compression tank insulation shall be one of the following:

1. Mineral-Fiber Board:

   a. Thickness; 1 inches .
   b. Nominal Density:

      1) 3-lb/cu. ft.

2. Mineral-Fiber Pipe and Tank: 1 inch thick.
3. Calcium Silicate: 1-1/2 inches thick.

J. Chilled-water air-separator insulation shall be one of the following:

1. Mineral-Fiber Board:

   a. Thickness; 1 inches .
   b. Nominal Density:

      1) 3-lb/cu. ft.

2. Mineral-Fiber Pipe and Tank: 1 inch thick.
3. Calcium Silicate: 2 inches thick.

K. Heating-hot-water air-separator insulation shall be one of the following:

1. Calcium Silicate: 3 inches thick.
2. Mineral-Fiber Board:

   a. Thickness; 2 inches .
   b. Nominal Density:

      1) 3-lb/cu. ft.

3. Mineral-Fiber Pipe and Tank: 2 inches thick.

L. Thermal storage tank (brine, water, ice) insulation shall be one of the following:

1. Mineral-Fiber Board:

   a. Thickness; 3 inches .

   b. Nominal Density:

      1) 3-lb/cu. ft.

2. Mineral-Fiber Pipe and Tank: 3 inches thick.
3. Calcium Silicate: 4 inches thick.

M. Piping system filter-housing insulation shall be one of the following:

1. Mineral-Fiber Board:

   a. Thickness; 2 inches .
   b. Nominal Density:

      1) 3-lb/cu. ft.

2. Mineral-Fiber Pipe and Tank: 2 inches thick.

3.9 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:

1. PVC:

   a. Color;

      1) Plain.

   b. Thickness;

      1) 20 mils.

2. Aluminum:

   a. Texture;

      1) Smooth.

   b. Thickness;

1) 0.032 inch.

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. PVC:

a. Color;

1) Plain.

b. Thickness;

1) 20 mils.

2. Aluminum:

a. Texture;

1) Stucco Embossed.

b. Thickness;

1) 0.032 inch.

E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Aluminum:

a. Finish;

1) Bare.

b. Texture;

1) Stucco Embossed.

c. Pattern;

1) 2-1/2-Inch- Deep Corrugations.

d. Thickness:

1) 0.040 inch.

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:

1. None.

2. PVC:

a. Color;

1) Plain.

b. Thickness;

1) 20 mils.

3. Aluminum:

a. Texture;

1) Smooth.

b. Thickness;

1) 0.032 inch.

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum:

a. Finish;

1) Bare.

b. Texture;

1) Stucco Embossed.

c. Pattern;

1) Corrugated.

d. Thickness;

1) 0.032 inch.

E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Aluminum:

    a. Finish;

        1) Bare.

    b. Texture;

        1) Stucco Embossed.

    c. Pattern:

        1) 2-1/2-Inch- Deep Corrugations.

    d. Thickness:

        1) 0.040 inch thick.

END OF SECTION 230716

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping.
2. Chilled-water piping.
3. Heating hot-water piping.
4. Steam and steam condensate piping.
5. Refrigerant suction and hot-gas piping.

B. Related Sections:

1. Section 230713 "Duct Insulation."
2. Section 230716 "HVAC Equipment Insulation."

1.3 DEFINITIONS:

A. Refer to Section 230500 “Common Work Results for HVAC”.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.8 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.9 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Insulation for below-ambient service requires a vapor-barrier.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Calcium Silicate:

1. Products: Subject to compliance with requirements, provide the following:

a. Industrial Insulation Group (IIG); Thermo-12 Gold.

2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

H. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.

b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553,

1. Type II and ASTM C 1290, Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
2. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000-Degree Pipe Insulation.
c. Manson Insulation Inc.; Alley-K.
d. Owens Corning; Fiberglas Pipe Insulation.
e. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A:

1) with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied:

1. ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; CrimpWrap.
b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation.
d. Manson Insulation Inc.; AK Flex.
e. Owens Corning; Fiberglas Pipe and Tank Insulation.

L. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide the following:

   a. Ramco Insulation, Inc.; Super-Stik.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, provide the following:

   a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-97.
   b. Eagle Bridges - Marathon Industries; 290.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-27.
   d. Mon-Eco Industries, Inc.; 22-30.
   e. Vimasco Corporation; 760.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Aeroflex USA, Inc.; Aeroseal.
   b. Armacell LLC; Armaflex 520 Adhesive.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
   d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Dow Corning Corporation; 739, Dow Silicone.
   b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
   c. P.I.C. Plastics, Inc.; Welding Adhesive.
   d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
   b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
   b. Eagle Bridges - Marathon Industries; 570.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: 60 percent by volume and 66 percent by weight.

5. Color: White.

2.5 SEALANTS

A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

   1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Johns Manville; Zeston.
      b. P.I.C. Plastics, Inc.; FG Series.
      c. Proto Corporation; LoSmoke.
      d. Speedline Corporation; SmokeSafe.

   2. Adhesive: As recommended by jacket material manufacturer.

   3. Color: Color-code jackets based on system:

      a. PVC, Color-Coded by System: 30 mils thick.

   4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications:

1) 1-mil- thick, heat-bonded polyethylene and kraft paper.

d. Moisture Barrier for Outdoor Applications:

1) 3-mil- thick, heat-bonded polyethylene and kraft paper.

e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.

b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.

c. Compac Corporation; 104 and 105.

d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at

   a. 2 inches o.c.

   b. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe

insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation same as pipe insulation.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric:

1) 1/2 inch thick

b. Mineral-Fiber, Preformed Pipe Insulation, Type I:

1) 1/2 inch thick

B. Chilled Water, 40 Deg F and below:

1. NPS 1-1/2 inch and Smaller: Insulation shall be the following:

a. Flexible Elastomeric:

1) 1-1/2 inch thick.

2. NPS 2 inch and Larger: Insulation shall be the following:

a. Flexible Elastomeric:

1) 2 inch thick

3. Insulation for runouts not exceeding 48 inches in length for connection to equipment shall be the following:

a. Flexible Elastomeric: 1 inch thick.

C. Chilled Water, above 40 Deg F:

1. NPS 1-1/2 inch and Smaller: Insulation shall be the following:

a. Flexible Elastomeric:

1) 1-1/2 inch thick.

b. Mineral-Fiber, Preformed Pipe, Type I:

1) 1-1/2 inches thick.

2. NPS 2 inch and Larger: Insulation shall be the following:

a. Flexible Elastomeric:

1) 2 inch thick.

b. Mineral-Fiber, Preformed Pipe, Type I:

1) 2 inch thick.

3. Insulation runouts not exceeding 48 inches in length for connection to equipment shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.
b. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick

D. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. NPS 1 1/2 and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I:

1) 1-1/2 inch thick

2. Greater than NPS 1-1/2 inch : Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I or Pipe and Tank Insulation:

1) 2 inches thick

3. Insulation for runouts not exceeding 48 inches in length for connection to equipment shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.

E. Heating-Hot-Water Supply and Return, above 200 Deg F:

1. NPS 1 and Smaller: Insulation shall be one of the following:

a. Calcium Silicate:

1) 2 inches thick

b. Mineral-Fiber, Preformed Pipe, Type I or II:

1) 1-1/2 inches thick

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:

a. Calcium Silicate:

1) 3 inches thick

b. Mineral-Fiber, Preformed Pipe, Type I or II:

1) 2 inches thick

3. Insulation runouts not exceeding 48 inches in length for connection to equipment shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.

F. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.

G. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. PVC:

a. PVC, Color-Coded by System: 50 mils thick.

E. Steam Piping, Exposed:

1. Aluminum, Stucco Embossed: 0.016 inch thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. Aluminum, Stucco Embossed: 0.016 inch thick.

3.14 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 230719

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 230900

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Facility Management and Control System (FMCS) Contractor shall furnish and install a fully integrated building automation system expansion, incorporating direct digital control (DDC) for energy management, equipment monitoring and control as herein specified. The system shall include all required computer software modifications and hardware additions. The system shall be an expansion to the Layton Ambulatory Surgical Center complete with programming additions and graphics additions.

B. System shall be Niagara 4.

C. The system shall use BacNet as its floor level protocol. System components shall be certified and display the BTL logo where applicable.

D. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed especially for this project

E. Plenum rated cable is allowed for low voltage control wiring.

F. Control voltage on each floor for VAV boxes, fan coil units, phoenix valves and other mechanical equipment is located in the electrical rooms. See electrical drawings for location.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including General and supplementary Conditions and Division-1 specification sections, apply to work of this section.

B. Products furnished but not installed under this section:

1. Valves, flow switches, flow sensors, thermowells and pressure taps to be installed under Section 23000.

2. Automatic dampers to be installed under Section 23000.

C. Coordination with electrical:

1. Installation of all line voltage power wiring by Division 26000 with the exception where line voltage power wiring is required by the FMCS and is not show to be provided by Division 26000, it shall be furnished as part of the work of the FMCS.

2. Each motor starter provided under Division 26000, shall be furnished with individual control power transformer to supply 120 volt control power and auxiliary contacts (one N.O. and one N.C.) for use by this section.

3. All variable frequency drives for the project are furnished under Division 23000, mechanical contractor. Each shall be furnished with a lockable disconnect. See other requirements for all VFDs in division 26000 specifications.

1.3 QUALITY ASSURANCE

A. The system shall be furnished, engineered, and installed by the manufacturers' locally authorized representative. The controls contractor shall have factory-trained technicians to provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.

B. At the time of bid, all FMCS Application Specific Controllers and Programmable Equipment Controllers shall be listed as follows:

1. Underwriters Laboratory UL 916

2. FCC Regulation, Part 15, Class B

1.4 SUBMITTALS

A. Submit 1 electronic complete sets of documentation in the following phased delivery schedule:

1. Valve and damper schedules

2. Equipment data cut sheets

3. System schematics, including:

   a. sequence of operations
   b. point names
   c. point addresses
   d. point to point wiring
   e. interface wiring diagrams
   f. panel layouts
   g. system riser diagrams
   h. graphics

4. AutoCAD® compatible as-built drawings

B. Upon project completion, submit operation and maintenance manuals, consisting of the following:

1. Index sheet, listing contents in alphabetical order

2. Manufacturer's equipment parts list of all functional components of the system, disk of system schematics, including wiring diagrams

3. Description of sequence of operations

4. As-Built interconnection wiring diagrams

5. User's documentation containing product, system architectural and programming information.

6. Trunk cable schematic showing remote electronic panel locations, and all trunk data

7. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)

8. Conduit routing diagrams

9. Copy of the warranty/guarantee

10. Operating and maintenance cautions and instructions

11. Recommended spare parts list

12. Drawings showing locations of duct static delta pressure sensor, building static delta pressure sensor, reheat loop delta pressure sensor, VAV transformers (In Electrical Room 181) and VAV communication network diagram.

1.5 COMMISSIONING COORDINATION

A. The Temperature Controls Contractor shall coordinate all work with the Commissioning Agent. Work will include but not be limited to control sequence review meetings, establish remote BMS access, functional testing and retesting.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Extension of the existing Siemens Controls System.

2.2 The Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers. The FMCS shall incorporate BacNet technology. The system shall include:

A. Programmable Equipment Controllers (PEC's) for control of primary mechanical systems and distributed system applications. Controllers shall be fully programmable to create custom control solutions.

B. Network Area Controllers (NAC's) for distributed system applications, databases and networking functions.

C. Application Specific Controllers (ASC's) for control of VAV terminal units, fan coil terminal units, unit vent terminal units, heat pump units and other terminal equipment.

D. Graphical User Interface (GUI), which includes the hardware and software necessary for a user to interface with the control system and devices.

E. The zone controller network shall use twisted pair wiring and 78Kbps RS485 BacNet MSTP wiring topologies. The GU, PEC and NAC shall reside on a 100 Mb Ethernet backbone.

F. All components and controllers supplied under this contract shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data shall not be acceptable.

G. Communication and integration of 3rd party BacNet products shall be accomplished without gateways or interface devices. The 3rd party product supplier shall provide BacNet PIC statements for each device.

2.3 NETWORK AREA CONTROLLER (NAC)

A. The Network Area Controller (NAC) shall provide the interface between the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. The NAC shall be JACE 8000. JACE 8000 – Niagara 4 compatible and integrated to Intermountain Healthcare’s central supervisory server. It shall be capable of executing application control programs by the owner to provide:

1. Calendar functions
2. Scheduling
3. Trending
4. Alarm monitoring and routing
5. Time synchronization
6. Integration of BacNet controller data
7. Integration of BacNet and MODBUS networks
8. Lon Network
9. Monitoring, control, and programming of all points.
10. Network Management functions for all BacNet based devices

B. The NAC shall provide multiple, concurrent user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

C. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users and be integrated to the central server.

D. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

1. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
2. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:

   a. To alarm
   b. Return to normal
   c. To fault

3. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
4. Provide timed (schedule) routing of alarms by class, object, group, or node.

5. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

E. Alarms shall be annunciated in any of the following manners as user defined:

1. Screen message text
2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:

   a. Day of week
   b. Time of day
   c. Recipient

3. Pagers via paging services that initiate a page on receipt of email message
4. Graphic with flashing alarm object(s)
5. Printed message, routed directly to a dedicated alarm printer

F. The following shall be recorded by the NAC for each alarm (at a minimum):

1. Time and date
2. Location (building, floor, zone, office number, etc.)
3. Equipment (air handler #, access way, etc.)
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

G. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

H. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

I. Provide a “query” feature to allow review of specific alarms by user defined parameters.

J. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

K. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

L. Data Collection and Storage

1. The NAC shall have the ability to collect data for any property of any object and store this data for future use.
2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

   a. Designating the log as interval or deviation.
   b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
   c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.

d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

3. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.
4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
5. All log data shall be available to the user in the following data formats:

   a. HTML
   b. XML
   c. Plain Text
   d. Comma or tab separated values

6. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
7. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:

   a. Archive on time of day
   b. Archive on user-defined number of data stores in the buffer (size)
   c. Archive when buffer has reached its user-defined capacity

M. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:

   1. Time and date
   2. User ID
   3. Change or activity: i.e., Change set point, add or delete objects, commands, etc.

N. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.

   1. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
   2. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

O. Each Network Area Controller (NAC) that is part of the Ethernet backbone shall include local battery backed UPSs sized for 30 minutes backup.

2.4 PROGRAMMABLE EQUIPMENT CONTROLLERS (PEC)

A. Programmable Equipment Controllers (PEC's) shall be stand-alone, multi-tasking, real-time digital control processors.

B. The PEC's shall communicate via native BacNet MSTP protocol. Provide a minimum of 4MB Random Access Memory in each PEC.

C. The PEC must communicate peer-to-peer with the all of the network application specific, programmable controllers and third party BacNet devices.

D. Programming of the PEC shall be accomplished by using graphical software that incorporates drag and drop capabilities. The PEC software database must be able to execute all of the specified mechanical system controls functions. The programming software shall be able to bundle software logic to simplify control sequencing. All values, which make up the PID output value, shall be readable and modifiable at a workstation or portable service tool. Each input, output, or calculation result shall be capable of being shared/bound with any controller or interface device on the network.

E. PEC's shall be able to execute custom, job specific processes defined by the user, to automatically perform calculations and special control routines.

F. A single process shall be able to incorporate measured or calculated data from any and all other PEC's on the network. In addition, a single process shall be able to issue commands to points in any and all other PEC's on the network.

G. Each PEC shall support firmware upgrades without the need to replace hardware.

H. Each PEC shall continuously perform self-diagnostics, which include communication diagnosis and diagnosis of all components. The PEC shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

I. In the event of the loss of normal power, there shall be an orderly shutdown of all PEC's to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

   1. Upon restoration of normal power, the PEC shall automatically resume full operation without manual intervention.
   2. All PEC's control programming and databases must be stored in Flash memory, therefore eliminating data loss, down time and re-load time.

2.5 APPLICATION SPECIFIC CONTROLLERS (ASC)

A. Each Application Specific Controller (ASC) shall operate as a stand-alone BACnet MSTP compliant controller capable of performing its specified control responsibilities independent of other controllers in the network. Each ASC shall be a minimum 16-BIT microprocessor based, multi-tasking, multi-user, real time digital control processor.

B. Service pin initiation shall be accomplished from the room sensor and/or the controller. ASC room sensors that do not provide service pin initiation must provide a wall jack by the room sensor to enable this feature.

C. Controllers shall include all inputs and outputs necessary to perform the specified control sequences. Analog and digital outputs shall be industry standard signals such as 0-10V and 3-point floating control allowing for interface to a variety of industry standard modulating actuators. The ASC inputs and outputs shall consist of industry standards types. Inputs shall be electrically isolated from outputs, communications and power. All inputs shall be provided with an auto-calibrate function to eliminate sensing errors.

D. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the network is not acceptable.

E. The ASC must be mounted remotely from the room sensor. ASC's, that are wall mounted with integral room sensors, are not acceptable.

F. The control program shall reside in the ASC. The application program and the configuration information shall be stored in non-volatile memory with no battery back-up required.

G. After a power failure the ASC must run the control application using the current set points and configuration. Reverting to default or factory set points is not acceptable.

2.6 GRAPHICAL USER INTERFACE SOFTWARE (GUI) (EXISTING)

A. Operator workstations must be capable of supporting any LonMark or BacNet compliant product. The operator shall not be able to distinguish the DDC points from different manufacturers when commanding, monitoring points or acknowledging alarms.

B. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. The GUI software shall run on a Windows 10 operating system. The operator shall be able to work in Microsoft Word, Excel, and other Windows10 based software packages, while concurrently annunciating on-line BMS alarms and monitoring information. If the software is unable to display several different types of displays at the same time, the FMCS contractor shall provide at least two operator workstations at each location specified.

C. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:

1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.

2. A gallery of HVAC and automation symbols shall be provided, including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams and symbols. The user shall have the ability to add custom symbols to the gallery as required.

3. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.

4. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.

5. Modifying common application objects, such as schedules, calendars, and setpoints shall be accomplished in a graphical manner.

    a. Schedule times will be adjusted by mouse command using a graphical slider, without requiring any keyboard entry from the operator.
    b. Holidays shall be set by mouse command using a graphical calendar, without requiring any keyboard entry from the operator.

6. Commands to start and stop binary objects shall be done by mouse command from the pop-up menu. No entry of text shall be required.

7. Adjustments to analog objects, such as set points, shall be done by mouse command using a graphical slider to adjust the value. No entry of text shall be required.

D. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:

1. Create, delete or modify control strategies

2. Add/delete objects to the system

3. Tune control loops through the adjustment of control loop parameters

4. Enable or disable control strategies

5. Generate hard copy records or control strategies on a printer

6. Select points to be alarmable and define the alarm state

7. Select points to be trended over a period of time and initiate the recording of values automatically

8. Owner must be furnished a copy of programming software. See training requirements below.

E. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

F. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

G. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

H. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.

I. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.7 WEB BROWSER CLIENTS(EXISTING)

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer® or Netscape Navigator® or Chrome®. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Web page access and control shall be from the system Network Area Controllers, or the Workstation.

C. The Web browser shall provide the same system view, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password security shall be required and implemented using current encryption techniques to prevent unauthorized access. If an unauthorized user attempts access, a blank web page shall be displayed.

2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.

3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.

4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client machine are not acceptable.

5. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.

6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

    a. Modify in a graphical manner, common application objects, such as schedules, calendars, and set points. Schedule times will be adjusted by mouse command using a graphical slider, without requiring any keyboard entry from the operator. Holidays shall be set by mouse command using a graphical calendar, without requiring any keyboard entry from the operator.
    b. Commands to start and stop binary objects shall be done by mouse command right-click of the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
    c. View logs and charts
    d. View and acknowledge alarms

7. The system shall provide the capability to specify a user's home page (as determined by the log-on user identification). The system shall provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

E. Trend logging and system monitoring requirements.

1. Trend data shall be stored for three years and be accessible through web-browser-based reporting tools.

2.8 BACNET NETWORK MANAGEMENT(EXISTING)

A. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics and device maintenance.

B. The network management tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

C. These tools shall provide the ability to "learn" an existing BacNet network, regardless of what network management tool(s) were used to install the existing network, so that existing devices and newly added devices are part of a single network management database.

D. The network management database shall be resident in the Network Area Controller (NAC), ensuring that users with proper authorization have access to the network management database at all times. Systems employing network management databases that are not resident at all times within the control system shall not be accepted.

2.9 PROJECT SPECIFIC WEB PAGES (EXISTING)

A. Home page shall include a campus layout of the individual buildings at the site. Once an individual building is selected the following minimum web-based tree structure shall be provided:

1. Documents Page: The document page shall include the O&M Manuals for the control system in PDF format along with AutoCAD drawings for each drawing provided in the control system O&M Manual.

2. Station Functions:

   a. Logging separate sheet of station functions for a particular selected building shall be the viewing of one or more logs or the creation of logs in which any value at any point, or the mode of any point, shall be selected via the web to be trended against any other point with an adjustable frequency in seconds, minutes, hours or days.
   b. The alarm acknowledgement via the web shall allow the viewing and acknowledgement of the alarms.
   c. Audit log shall be provided via the web to show the operator actions as well as other audit logs as specified in section 2.5 Network Area Controller (NAC) paragraph “M” Data Collection and Storage.

3. Floor Plans:

   a. AutoCAD drawings of floor plans shall be provided in the control system such that via the web the user shall be able to turn layers on and off on the mechanical floor plans. These floor plans shall also include an overlay of the temperature control as-built wiring for the project showing thermostat locations, communication runs, transformer locations, controller locations, etc.
   b. Floor Display Summaries. The operator shall be able to select floor plans displaying the following formats:

      1. All zone temperatures
      2. All zone heating percentages
      3. All zone cooling percentages
      4. All zone room names and numbers
      5. All zones cfm delivered.

   c. Upon selecting a graphical floor plan layout the web page shall show all the zone temperature sensor locations on the floor. By clicking on the zone temperature location, an individual VAV box graphic shall be displayed with the following attributes:

      1. A manual menu that shall allow the operator to manually set the air flow set point, space temperature set point, damper position, cooling percentage, heating percentage, and zero the box.
      2. A 24 hour log chart that shows space temperature history, flow history, and allows the operator to build custom charts by comparing this log to other associated selectable logs.
      3. A display of the VAV box discharge temperature, air handler discharge temperature, space temperature, and space temperature set point.
      4. A bar graph that shows actual CFM, current air flow, and current air floor set point, percentage of heating and cooling in a thermometer-like fashion and changes color based on heating or cooling mode.

5. The damper position, reheat valve position, occupancy status, room name and heating/cooling mode shall also be shown.

4. Systems:

a. On selecting the systems menu, a tree structure shall allow the operator to select the air handlers, boilers, chillers, control valves, pumps, heat exchangers, critical air flow valves, etc. systems associated with that building. The graphics shall also show the piping and ductwork associated with the air handler as well as the safeties, temperature sensors, humidity sensors, dampers, VFD's, associated with that fan system. See points lists for specifics.

b. All devices that provide dynamic function in the primary equipment, i.e., fans, pumps, coils, dampers shall be dynamic in nature showing their operating status/percentage of capacity by movement on the web page.

c. The set points for the various control loops shall be adjustable via the web page. Individual controlled devices, i.e. valves, dampers and fans shall be controlled via the web page and be stopped or started or placed in a command state or percentage of value output.

2.10 FIELD DEVICES

A. Provide automatic control valves, automatic control dampers, thermostats, clocks, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer.

B. TEMPERATURE SENSORS

1. Temperature Sensors: Temperature sensors shall be linear precision elements with ranges appropriate for each specific application. Where sensors are located in public areas they shall not employ set point adjustments or override capability. Set point adjustment shall be programmed for 2.5° maximum initially.

2. Space (room) sensors shall be available with LED touch display with temperature, set point adjustment and occupancy override.

3. Duct mounted averaging sensors shall utilize a sensing element incorporated in a copper capillary with a minimum length of 20 feet. The sensor shall be installed according to manufacture recommendation and looped and fastened at a minimum of every 36 inches.

4. Air handler mounted sensors require a minimum of one liner foot of averaging sensor for every 2 square feet of air handler cross section. Sensors are required to be provided in groups of 1, 4, or 9 for ease of wiring for using only one controller input.

5. Sunshields shall be provided for outside air sensors.

6. Thermo-wells for all immersion sensors shall be stainless steel or brass as required for the application.

C. Humidity Sensors: Humidity sensors shall be of the solid-state type using a capacitance-sensing element. The sensor shall vary the output voltage with a change in relative humidity.

Room humidity sensors shall have a minimum range of 10% to 90% ±5%. Supply air humidity sensors shall have a normal range of 10% to 90% ± 5%.

D. Air Velocity Sensors: The sensor shall use differential pressure to determine airflow rate and have repeatability within 1% of reading and an accuracy of ± 5% of range. The velocity range shall be from 0 to 3250 FPM.

E. Pressure Sensors: The differential pressure sensor shall be temperature compensated and shall vary the output voltage with a change in differential pressure. Sensing range shall be suitable for the application with linearity of 1.5% of full scale and offset of less than 1% of full scale. Sensors shall be capable of withstanding up to 150% of rated pressure without damage. Sensor range shall not exceed 4 times the set point.

F. Building Static Pressure Transmitters and Building Sensing Arrays: Building static pressure transmitter installations shall include four runs of equal length 3/8 pneumatic tubing to the four exposures of the building. The indoor transmitter reference point shall be the lobby if the air handler serves the lobby or a public outside entrance. For the upper floors of the building, the indoor reference point shall be the elevator lobby of the middle floor served by the air handler, with the outdoor references located on the same floor as the elevator lobby reference with equal length 3/8 tubing to each exposure of the building. A 4-point OSA reference shall also be used for penthouse relief wall control.

Outdoor pickups shall include a bug screen to prevent insects from plugging and shielded to prevent rainwater or snow from entering the pickup sensor.

G. SWITCHES AND THERMOSTATS

1. The FMCS Contractor shall furnish all electric relays and coordinate with the supplier of magnetic starters for auxiliary contact requirements. All electric control devices shall be of a type to meet current, voltage, and switching requirement of their particular application. Relays shall be provided with 24 VAC coils and contacts shall be rated at 10 amps minimum.

2. Differential Pressure Switches: Pressure differential switches shall have SPDT changeover contact, switching at an adjustable differential pressure set point.

3. Low Temperature Detection Thermostats: Shall be the manual reset type. The thermostat shall operate in response to the coldest one-foot length of the 20-foot sensing element, regardless of the temperatures at other parts of the element. The element shall be properly supported to cover the entire downstream side of the coil with a minimum of three loops. Separate thermostats shall be provided for each 25 square feet of coil face area or fraction thereof.

4. Current Sensing Relays: Motor status indications, where shown on the plans point list shall be provided via current sensing relays. The switch output contact shall be rated for 30 VDC, .15 amps.

5. Flow Switches: Motor status indications, where shown on the plans point list, shall be provided via flow switches. Flow switches shall be of the paddle type equipped with SPDT contacts to establish proof of flow.

H. CONTROL VALVES

1. General: Control Valves up to 4 inches shall be sized for a 3 to 5 psi pressure drop. Valves shall be pack-less, modulating, electrically or magnetically actuated, with a control rangeability of 100 to 1. These valves shall have true equal percentage flow characteristics in relationship to valve opening.

2. ½ inch to 4 inches: Valves shall be equipped with handwheel, or manual position mounted dial adjacent to valve, to allow manual positioning of valve in absence of control power.

3. 4 inches to 6 inches: Valves shall be modulating electrically actuated, 2-way or 3-way as required, with a rangeability of 50 to 1. Valve body shall be flanged and shall be equipped with a handwheel, or manual position dial mounted adjacent to the valve, to allow manual positioning of the valve in the absence of control power.

4. Butterfly Valves: 2-way and 3-way butterfly valves shall be cast iron valve body, with stainless steel stem, and available with disc seal for bubble-tight shut off.

I. DAMPER ACTUATORS

1. Actuators shall be of the push-pull or rotary type of modulating, 3-point floating, or 2-position control as required by the application. The actuator shall use an overload-proof synchronous motor or an electric motor with end switches to de-energize the motor at the end of the stroke limits. Control voltage shall be 24 VAC, 0-20 VDC, or 4-20 ma as required. Actuators shall be available with spring return to the normal position when required. Actuators shall have a position indicator for external indication of damper position. Actuators shall have manual override capability without disconnecting damper linkage. Actuators for purge system shall meet failsafe and smoke control speed requirements.

J. CONTROL DAMPERS

1. Motorized dampers, unless otherwise specified elsewhere, shall have damper frames using 13-gauge galvanized steel channel or 1/8” extruded aluminum with reinforced corner bracing. Damper blades shall not exceed ten (10) inches in width or 48” in length. Blades are to be suitable for high velocity performance. Damper bearings shall be as recommended by manufacturer for application. Bushings that turn in the bearing are to be oil impregnated sintered metal. All blade edges and top and bottom of the frame shall be provided with replaceable, butyl rubber or neoprene seals. Side seals may be spring-loaded stainless steel. The seals shall provide a maximum of 1% leakage at a wide-open face velocity of 1500 FPM and 4: W.C. close-off pressure. The damper linkage shall provide a linear flow or equal percentage characteristic as required. Provide Ruskin RCD46 model.

2. Control dampers shall be parallel or opposed blade type as scheduled on drawings or outdoor and return air mixing box dampers shall be parallel blade arranged to direct air streams towards each other. All other dampers may be parallel or opposed blade types.

2.11 AIRFLOW MEASURING STATION (These shall be provided for all air handling equipment and shall be provided by the Controls Contractor)

A. General:

1. Provide Ebtron Gold or Air Monitor Electraflo, VOLU-probe and VOLU-flo/OAM total

supply air, and outside, and return air flow measurement stations (AFMS) for each new air handling unit and return fans.

2. AFMS shall consist of single or multiple probes as required to achieve an airflow measurement accuracy of ± 3% of reading.
3. AFMS probe assemblies must have multiple sensors that use instrument grade thermal dispersion, temperature compensated, thermistor sensing technology and digital electronics.
4. The AFMS manufacturer &/or their local representative shall recommend and approve the actual location for the AFMS and determine whether or not a honeycomb straightener is required.
5. Vortex shedding or pitot tube arrays and differential pressure sensing arrays with sensors that require auto-zeroing will not be accepted.
6. The basis of design for the AFMS is powered by the low voltage controls. If line voltage is required, it will be the responsibility of this section to coordinate and provide line voltage at no additional cost to the owner.
7. The flow monitor/controller shall be capable of direct measurement of airflow through an outside air inlet and produce dual outputs; one representing the measured airflow, and the other to control the inlet damper.

   The monitor/controller shall contain an integral multi-line liquid crystal display for use during the configuration and calibration processes, and to display two measured processes (volume, velocity, temperature) during normal operation. All configuration, output scaling, calibration, and controller tuning will be performed digitally in the on-board microprocessor via input pushbuttons.

   The monitor/controller shall measure inlet airflow with an accuracy of ±5% of reading over range of 150-600 FPM, 2501,000 FPM, 500-2,000 FPM, and 150-2,000 FPM and not have its reading affected by the presence of directional or gusting wind. Measured airflow shall be density corrected for ambient temperature variances, and atmospheric pressure due to site altitude.

   The monitor/controller shall interface with existing building automation systems (BAS), accepting inputs for fan system start, economizer mode operation, and an external controller setpoint, and provide flow deviation alarm outputs.

   The sensors shall be constructed of materials that resist corrosion due to the presence of salt or chemicals in the air; all non-painted surfaces shall be constructed of stainless steel. The electronics enclosure shall be NEMA 1.
8. Provide where indicated, an array of airflow traverse probes capable of continuously monitoring the fan or duct capacities (air volumes) they serve.

   Each airflow traverse probe shall contain multiple total and static pressure sensors located along the exterior surface of the cylindrical probe and internally connected to their respective averaging manifolds. The flow sensors shall not protrude beyond the surface of the probe(s) and shall be the offset (Fechheimer) type for static pressure and the chamfered impact type for total pressure measurement. The airflow sensing probe's measurement accuracy shall not be affected by directional flow having pitch and/or yaw angles up to 30º. Each airflow traverse probe shall be of extruded aluminum construction and furnished with mounting plate(s), gasket, and signal fittings suitable for HVAC duct installation.

   Total and static pressure sensors shall be located at the centers of equal areas (for

rectangular ducts) or at equal concentric area centers (for circular ducts) along the probe length.

Probes shall be AMCA certified and be capable of measuring the airflow rates within an accuracy of ±2% without the use of correction factors. The maximum allowable unrecovered pressure drop caused by the probes shall not exceed .025" w.c. at 2000 FPM, or .085" w.c. at 4000 FPM.

9. The transmitter shall be capable of receiving flow signals (total and static pressure) from an airflow station or probe array and produce an output linear and scaled for air volume, velocity, differential pressure, etc.

   The transmitter shall contain an integral multi-line digital display for use during the configuration and calibration process, and to display one transmitter output during normal operating mode. All transmitter configuration, parameter setting, zero and span calibration, plus display formatting and scaling will be performed digitally in the on-board microprocessor via input pushbuttons.

   The transmitter will be available in multiple spans covering the range of 0.05 IN w.c. to 25.0 IN w.c. with an accuracy of 0.25% of natural span. The transmitter shall be furnished with a transducer automatic zeroing circuit and be capable of maintaining linear output signals on applications requiring 10 to 1 velocity turndown.

B. Sensors:

1. Each sensing point shall consist of one glass encapsulated self-heated thermistor for velocity sensing and one glass encapsulated thermistor for temperature sensing.
2. Sensors must be hermetically sealed to be water resistant and capable of being frequently exposed to moisture without causing sensor failure.
3. Factory calibration: @ 0 fpm & @ 16 different airflow rates to NIST standards.
4. Velocity accuracy: ~ 2% of reading.
5. Temperature accuracy: + 0.180F.
6. Velocity output scaling: 0-500; 0-1000; 0-2500; 0-5000 or 0-10000 fpm (as required by the application).
7. Operating temp. Range: ~20o to 1600 F.
8. Operating RH Range: 0 to 99% (non-condensing).

C. Probes:

1. Aluminum, 316 stainless steel or gold anodized bodies with 2 to 8 sensors per probe.
2. Air pressure drop: 0.0005 in wg. @ 2000 fpm (maximum).

D. Electronics:

1. Microprocessor based, totally solid state, industrial grade integrated circuits that do not require periodic calibration.
2. Each sensor shall be independent from any other sensor.
3. An intelligent "sensor detection system" (SDS) shall put the transmitter into an alarm mode is any sensor or the transmitter is not operating properly.
4. The SDS shall ignore any sensor that is inoperable and utilize only the remaining operable sensors to determine airflow and assure an accurate and uninterrupted output signal.
5. Transmitter outputs: 4-20 ma; 0-10 vdc; N2~ or Modbus~.

6. Operating temp. Range: -20~ to 1600F.
7. Operating RH range: 0 to 99% (non-condensing).
8. Multi-character based for transmitter visual interface (note: LCD available or Gold Series product line only).

E. Start-up:

1. Factory authorized start-up certification and owner-training services must be provided and conducted by the AFMS manufacturer's local representative.

F. Warranty:

1. 24 months from date of start-up certification.

2.12 SYSTEM COMPONENTS CRITICAL AIR FLOW

A. The Critical Airflow system for ORs and Central Processing rooms shall include a five (5) year material and workmanship manufacturer's warranty.

2.13 AIRFLOW CONTROL DEVICE – GENERAL

A. The airflow control device shall be a Venturi valve by Phoenix Controls.

A. The valve assembly manufacturer's Quality Management System shall be registered to ISO 9001:2000.

B. The airflow control device shall be pressure independent over its specified differential static pressure operating range. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change or quantity of airflow controllers on a manifold system.

C. The airflow control device shall maintain accuracy within ±5% of signal over an airflow turndown range of no less than:

Pressure Drop Range	Airflow	Turndown	Valve Type
0.6- 3.0-inch WC	Devices up to 1,000 CFM (472 l/s)	20 to 1	Standard
	Devices up to 1,500 CFM (708 l/s)	16 to 1	Standard
	Devices up to 2,500 CFM (1,180 l/s)	12 to 1	Standard
	Devices up to 850 CFM (401 l/s)	17 to 1	Shutoff
	Devices up to 1,300 CFM (614 l/s)	14 to 1	Shutoff

0.3- 3.0-inch WC	Devices up to 550 CFM (260 l/s)	11 to 1	Standard
	Devices up to 1,050 CFM (496 l/s)	11 to 1	Standard

D. No minimum entrance or exit duct diameters shall be required to ensure accuracy and/or pressure independence.
E. The airflow control device shall be constructed of the following:
   1. Class A: The airflow control device for non-corrosive airstreams, such as supply and general exhaust, shall be constructed of 16-gauge aluminum. The device's shaft and shaft support brackets shall be made of 316 stainless steel. The pivot arm and internal mounting link shall be made of aluminum. The pressure independent springs shall be a spring-grade stainless steel. All shaft bearing surfaces shall be made of a Teflon, polyester or PPS (polyphenylene sulfide) composite.
   2. Sound attenuating devices used in conjunction with general exhaust or supply airflow control devices shall be constructed using 24 gauge galvanized steel or other suitable material used in standard duct construction. No sound absorptive materials of any kind shall be used.

F. Actuation

   1. For electrically actuated VAV operation, a UL 916 listed electronic actuator shall be factory mounted to the valve. Loss of main power shall cause the valve to position itself in an appropriate failsafe state. Options for these failsafe states include: normally open-maximum position, normally closed-minimum position and last position. This position shall be maintained constantly without external influence, regardless of external conditions on the valve (within product specifications).

   2. The shutoff airflow control device shall have shutoff and casing leakage of no more than:

Static Pressure Across Valve in Shutoff	Airflow	Shutoff Leakage	Casing Leakage
5.0-inch WC	Shutoff devices up to 850 CFM (472 l/s)	6 CFM	0.12 CFM/ ft²
	Shutoff devices up to 1,300 CFM (708 l/s)	6 CFM	0.12 CFM/ ft²
	Low leakage shutoff devices up to 850 CFM (472 l/s)	0.005 CFM	0.010 CFM/ ft²
	Low leakage shutoff devices up to 1,300 CFM (708 l/s)	0.010 CFM	0.010 CFM/ ft²

G. The controllers for the airflow control devices shall be microprocessor based furnished by Phoenix with valves and operate using peer-to-peer control architecture. The room-level airflow control devices shall function as a standalone network.

H. The room-level control network shall utilize a BacNet MSTP communications protocol.

I. There shall be no reliance on external or building-level control devices to perform room-level control functions. Each critical airflow control system shall have the capability of performing fume hood control, pressurization control, temperature control, humidity control, and implement occupancy and emergency mode control schemes.

J. The venturi valves shall come equipped with a differential pressure transducer that measures the pressure drop across the valve. This value shall be an input into the valve DDC controller. The value shall be linked to the BAS system. The BAS contractor shall display the value on the system graphics for each valve.

K. Start-up and Commissioning Tool (Separate from the BMS Interface): The critical airflow control manufacturer shall provide to the owner a start-up and commissioning tool separate from any tools provided by the BAS contractor. The tool shall be a thin Client application that will allow access to the air flow control system through the customer's computer network. The access to the system must be web-enabled and the interface shall be through the use of standard internet browsers.

L. The tool shall be graphical based and allow for the adjustment of all set-up parameters.

M. A floor plan shall be provided that allows the operator to see the location of each pressurization zone in the building. The area will display the space temperature and or supply/exhaust flows for each area. A Schematic shall be provided for each pressurization zone. The schematic shall show the following;

1. All air flow devices i.e. hood valves, supply valves, general exhaust valves, etc. The flow and set-point valves for each device shall be displayed. The total supply, total exhaust, offset command, and offset value shall be shown as well

2. All temperature and humidity information that is controlled by the system shall also be displayed including but not limited to, supply duct temperature, heating coil valve position, space temperature, space temperature set point, percent heating or cooling demand, occupied/unoccupied status

3. A table of emergency modes shall be shown on the graphic at what the status of the mode is by selecting a valve on the schematic the operator will be taken to the parameter set-up pages for that valve.

N. Interface to Building Management Systems:

1. The critical airflow control system network shall be digitally integrated with the BAS.

2. All room-level points shall be mapped to the BMS for monitoring or trending.

3. Multiple BacNet IP gateways shall be provided in order to connect to the building-level network.

O. Interface to Building Management System

1. Native BACnet airflow controllers are also acceptable.

P. See the points list for integration with the BAS at a minimum. Any other points used by the system in its control sequences, but not shown here shall also be made available

1. The critical airflow control systems shall be integrated with the BMS, using BacNet IP.

Q. Certification

1. Each airflow control device shall be factory calibrated to the job site elevation specific airflows as detailed on the plans and specifications using NIST traceable air stations and instrumentation having a combined accuracy of no more than ±1% of signal over the entire range of measurement. Electronic airflow control devices shall be further calibrated and their accuracy verified to ±5% of signal at a minimum of 48 different airflows across the full operating range of the device.

2. Each airflow control device shall be marked with device-specific factory calibration data. At a minimum, it should include the tag number, serial number, model number, eight-point characterization information (for electronic devices), and quality control inspection numbers. All information shall be stored by the manufacturer for use with as-built documentation.

2.14 EXHAUST AND SUPPLY TRACKING PAIR DEVICE CONTROLLER

A. One controller shall be supplied for both the supply airflow control device and the corresponding exhaust air control device. The controller shall be a microprocessor-based design and use closed-loop control to linearly regulate airflow based on a digital control signal. The device shall generate a digital feedback signal that represents its airflow.

B. In flow tracking applications, where an exhaust device is tracking a supply device, flow data for each device shall be downloaded to the controller in the factory.

C. The airflow control device shall store its control algorithms in non-volatile, rewritable memory. The device shall be able to stand alone or to be networked with other room-level digital airflow control devices through an industry standard protocol.

D. Room-level flow tracking control functions shall be embedded in and executed by one controller mounted on one of the airflow devices.

E. The room-level control network shall communicate by using the BacNet MSTP protocol.

F. The airflow control device shall use 24 Vac power ±15%, the industry standard.

G. The airflow control device shall be able to connect a notebook PC commissioning tool. Every node on the local network shall be accessible.

H. The airflow control device shall have integral input/output for the following functions: temperature control, humidity control, occupancy control, emergency control, shut-off control, and non-network sensor switches and control devices. At a minimum, the airflow controller shall have:

1. Base models shall have three universal inputs capable of accepting 0 to 10 Vdc, 4 to 20 mA, 0 to 65 K ohms, or Type 2 or Type 3, 10 K ohm @ 25 degree C; thermistor temperature sensors available for space temperature, set point lever adjust and discharge air temperature.

2. Expanded models shall have five universal inputs capable of accepting 0 to 10 Vdc, 4 to 20 mA, 0 to 65 K ohms, or Type 2 or Type 3, 10 K ohm @ 25 degree C, thermistor temperature sensors available for space temperature, set point lever adjust and discharge air temperature, humidity control (UI 4 and 5) and pressure monitoring (UI 4 and 5).

3. One digital input capable of accepting a dry contact or logic-level signal input, which may be used for occupancy override via a local room-level sensor.

4. All inputs shall have an accuracy of ±1% F.S.

5. All models shall have two analog outputs capable of developing either a 0 to 10 Vdc or 4 to 20 mA linear control signal, to be available for duct reheat and ancillary room heat (i.e., fin tube radiation, radiant heat panels, each with its own independent PID control loops).

6. All models shall one floating point Triac® output available for proportional reheat coil valve operation. This output shall have a rating of 6 VA Max at 24 VAC.

7. All models shall have one Form C (SPDT) relay output capable of driving up to 1 A @ 24 Vac/Vdc to be available for local audio/visual alarms.

8. All outputs shall have the following accuracies:

   a. 0 to 10 Vdc- ± 1% F.S. into 10 K ohms minimum
   b. 4 to 20 mA- ±1% F.S. into 500 ohms, +0 ohms/ -50 ohms

9. The airflow control device shall meet the following agency compliance requirements: FCC Part 15 Subpart J Class A, CE and CSA.

2.16 CRITICAL AIR FLOW INSTALLATION

A. The BAS contractor shall install all routers and repeaters in an accessible location in or around the designated OR room.

B. The BAS contractor shall install an appropriately sized and fused 24 Vac transformer suitable for NEC Class II wiring.

C. All cable shall be furnished and installed by the BAS contractor. The BAS contractor shall terminate and connect all cables as required. The BAS contractor shall utilize cables specifically recommended by the laboratory airflow controls supplier.

D. The mechanical contractor under Division 23 shall install all airflow control devices in the ductwork and shall connect all airflow control valve linkages.

E. The mechanical contractor under Division 23 shall provide and install all reheat coils and transitions.

F. The mechanical contractor under Division 23 shall provide and install insulation as required.

G. Each pressurization zone shall have either a dedicated, single-phase primary circuit or a secondary circuit disconnect.

H. Provide dedicated room pressure monitor per room with local digital display and displayed on BAS graphics.

2.17 SYSTEM START-UP AND TRAINING

A. System start-up shall be provided by a factory-authorized representative of the critical airflow control system manufacturer. Start-up shall include calibrating the fume hood monitor and any combination sash sensing equipment, as required. Start-up shall also provide electronic verification of airflow (fume hood exhaust, supply, make-up, general exhaust or return), system programming and integration to BAS system.

B. The balancing contractor shall be responsible for final verification and reporting of all airflows

C. The critical airflow control system supplier shall furnish a minimum of eight hours of owner training by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves and general troubleshooting procedures. The class will also show owner personnel step to replacing and reprogramming valves.

D. Operation and maintenance manuals, including as-built wiring diagrams and component lists, shall be provided for each training attendee.

2.18 PROJECT MANAGEMENT

A. Provide a manager who shall, as part of his duties, be responsible for the following activities:

1. Coordination between the Controls Contractor and all other trades, owner, local authorities and the design team.

2. Scheduling of manpower, material delivery, equipment installation and checkout.

3. Maintenance of construction records such as project scheduling and manpower planning and AutoCAD or Visio for project coordination and as-built drawings.

4. Coordination/single point of contact.

PART 3 - INSTALLATION

3.1 INSTALLATION METHODS

A. Install systems and materials in accordance with manufacturer's instructions, rough-in drawings and equipment details. Install electrical components and use electrical products complying with requirements of applicable Division 26000 sections of these specifications.

1. The contractor is required to deliver a functionally complete operating building. Provide unconditional one-year parts and service warranty. Warranty period commences when architectural substantial completion has been achieved and all the BMS controls.

   If a Cx agent is hired by the Owner. A Third Party review and certification is to be provided.

B. The term “control wiring” is defined to include providing of wire, conduit, and miscellaneous materials as required for mounting and connecting electric or electronic control devices.

C. All exposed wiring, low and line voltage subject to mechanical damage, shall be run in conduit. Line and low voltage wiring shall be run in separate conduits. Concealed but accessible wiring, except in mechanical rooms and areas where other conduit and piping are exposed shall run in UL plenum rated cable as approved by local codes unless expressly restricted by requirements in Division 26000 specification. Control wiring below 8 feet in Mechanical Rooms and areas exposed to severe physical damage (i.e. loading dock, corridors subject to carts, forklifts, etc.) may be run in EMT conduit in lieu of rigid conduit as required in Section 260533.

D. All controllers, relays, transducers, etc., required for stand-alone control shall be housed in a NEMA 1 enclosure with a lockable door.

E. All field installed wiring for smoke control stairwell pressurization shall meet 2 hour NEC and IBC requirements

F. Install VAV transformers in electrical rooms

G. UPS shall be installed on all control panels.

H. Install service gutters with service loops above all major equipment control panels.

I. Label both sides of all **wiring**, all **control** j-box covers and all devices and sensors.

3.2 SYSTEM ACCEPTANCE

A. General: The system installation shall be complete and tested for proper operation prior to acceptance testing for the Owner’s authorized representative. A letter shall be submitted to the Architect requesting system acceptance. This letter shall certify all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing will commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative, the system will be accepted. The warranty period will start at this time.

B. Field Equipment Test Procedures: DDC control panels shall be demonstrated via a functional end-to-end test. Such that:

   1. All output channels shall be commanded (on/off, stop/start, adjust, etc.) and their operation verified.

   2. All analog input channels shall be verified for proper operation.

3. All digital input channels shall be verified by changing the state of the field device and observing the appropriate change of displayed value.

4. If a point should fail testing, perform necessary repair action and retest failed point and all interlocked points.

5. Automatic control operation shall be verified by introducing an error into the system and observing the proper corrective system response.

6. Selected time and set point schedules shall be verified by changing the schedule and observing the correct response on the controlled outputs.

C. As-Built Documentation: After a successful acceptance demonstration, the Contractor shall submit as-built drawings of the completed project for final approval. After receiving final approval, supply "1" complete electronic PDF with AutoCAD or Visio files to the owner.

D. Operation and Maintenance Manuals: Submit one electronic copy of operation and maintenance manuals. Include the following.

1. Manufacturer's catalog data and specifications on sensors, transmitters, controllers, control valves, damper actuators, gauges, indicators, terminals, and any miscellaneous components used in the system.

2. An operator's manual that will include detailed instructions for all operations of the system.

3. An operator's reference table listing the addresses of all connected input points and output points. Settings shall be shown where applicable.

4. A copy of the warranty/guarantee.

5. Operating and maintenance cautions and instructions.

3.3 TRAINING

A. Contractor shall provide to the engineer a training class outline prior to any scheduled training.

B. Factory trained control engineers and technicians shall provide 10 training sessions (4 Hrs each) for the Owner's personnel.

C. The course shall include instruction on specific systems and instructions for operating the installed system to include as a minimum:
1. HVAC system overview
2. Operation of control system
3. Function of each component
4. System operating procedures
5. Programming procedures
6. Maintenance procedures

3.4 WARRANTY/GUARANTEE

A. The control system shall be warranted/guaranteed to be free from defects in both material and workmanship for a period of twelve (12) months of normal use and service. This warranty/guarantee shall become effective the date the owner accepts or receives beneficial use of the system as defined by Utah state law.

PART 4 SEQUENCE OF OPERATION

4.1 GENERAL

A. All mechanical equipment shall be monitored thru the DDC Control system with proof of flow devices. The run time of a monitored motors shall be available at the Facility Management System. Console. A maintenance alarm message shall be programmed at a specific run time as designated by the system operator. The alarm message shall be a designated by the operator.

4.2 VAV ZONES WITH REHEAT COIL

A. Occupied mode of the zone controller shall be determined by the central control. In the occupied mode if the space temperature is between the heating temperature and the cooling temperature set point, the box shall be in a dead band mode. The local DDC control loop shall modulate the primary damper to maintain the ventilation minimum CFM set point. On a fall in space temperature equal to the heating temperature set point, the controller shall then modulate the reheat coil as well as reset the supply air volume between the ventilation minimum and the heating maximum set point. The heating volume shall be a function of the heating calculation percentage to minimize the amount of reheat. On a 100% call for heat, the VAV box shall control to the maximum heating velocity set point and the control valve shall modulate subject to a discharge sensor/control loop that limits the supply air temperature to 17° above the space heating set point. Where the VAV zone serves a patient room, the space heating design set point is 80°. All other VAV zones serving non-patient rooms set point shall be 72°.

B. The reverse shall occur on an increase in space temperature equal to or greater than the heating temperature set point. When the space temperature is equal to or greater than the cooling temperature set point the VAV box shall enter the cooling mode. The controller shall reset the box CFM set point from the minimum ventilation set point to the cooling maximum set point. The Staff Lounge and other rooms shown on the plans, if the zone CO2 level is above **750** ppm, then the VAV box minimum shall be indexed upwards towards the cooling maximum, to meet the CO_2 set point maximum.

C. In the unoccupied mode the VAV box damper shall be closed and the reheat coil valve closed. On a fall in space temperature below the unoccupied heating set point the control valve shall open and the primary air damper shall control to the heating volume to maintain the night set back setting.

D. All VAV and constant volume boxes in the system shall be equipped with discharge air temperature sensors and the BMS shall monitor and display the discharge air temperature and damper position.

E. When the zone is scheduled for occupancy and a motioned controlled lighting sensor by

electrical contractor determines the space is vacant, the auxiliary contact in the motion sensor shall signal the VAV zone to go to zero ventilation minimum if there is no call for heating or cooling above 55° OSA temperature. Interlock wiring is by this contractor. See the mechanical HVAC drawings for locations where a VAV box serves one physical space, multiple spaces or where multiple VAV boxes serve one physical space. If a VAV box serves multiple spaces then the occupancy sensor located in each space will be tied into the VAV box. If one space is occupied the VAV box will operate to maintain space temperature. The interlock will occur where electrical has provided occupancy sensors for lighting control. See electrical

4.3 COOLING ONLY VAV BOXES

A. Cooling only VAV Boxes operate in identical sequence to the cooling mode of the VAV reheat box only it does not have reheat coils or heating minimums and is not connected to a local lighting occupancy sensor.

4.4 MEDICAL GAS:

A. Provide wiring between the pipe sensors and the area alarm panel located as shown on the drawings or directed by the engineer. Provide wiring between the medical gas manifolds and the building management system as directed by the engineer. This includes new and existing panel locations and interconnects required. Provide wiring between medical air compressors and vacuum pumps alarms and master alarm panels. The BMS shall receive the Med Gas alarm points and statuses and annunciate them in the existing and new **Nurses Station** as well as the engineer designated 24 hour manned location. Provide software, hardware and wiring to accomplish this.

PART 5 - FANS AND AIR HANDLERS

5.1 AIR HANDLERS AHU

A. NORMAL MODE:

1. The supply and return fans shall run continuously when started by the ATC system subject to fire alarm interlocks and ionization detector located in the supply and return air streams by Division 26 as well as a freeze stat and high and low pressure duct cutout switches. Control loops sensing the supply static pressure shall modulate the VFD on the supply fan to maintain the static pressure set point of 1.2 inches WC programmable subject to reset sequence below.
2. BAS system shall adjust the Supply duct static pressure sensor based on VAV box/air control valve damper position to minimize the amount of fan static pressure required. The supply duct static pressure set point shall be reset up from 0.8 inches WC at the rate of .05 inches WC per 10 minutes until any VAV/air control valve damper is at least 90% open to maximum of 1.2 inches WC programmable. All set points and parameters are adjustable. Any zone may be excluded in the poll via action of the operator. If no VAV box dampers are greater than 60% open, the duct static pressure set point shall be reset downward at .05 inches WC per 10 minutes to a minimum of 0.8 inches WC. ATC Contractor shall coordinate with the T&B Contractor to determine lowest possible supply duct static pressure that will work with the air control valves.
3. The heating coil valve, mixed air dampers, and cooling coil valve modulate in sequence without overlap to maintain the supply air temperature set point with a low limit of 46 degrees F at the mixed air sensor. The mixing dampers ramp open slowly to minimize overshooting.
4. The return fan VFD speed shall control to a return duct static pressure set point of 0.8 inches WC (adjustable). The **Relief Damper** shall be modulated to maintain the building

static pressure set point or **0.05** inches WC positive with respect to the outdoor reading (adjustable).

5. A control loop sensing the discharge air temperature shall modulate the outside and return air dampers as the first stage of discharge air temperature control. Above 78° F OSA temperature, the OSA dampers shall control to the minimum outside air flow set point as measured by the OSA air flow measurement station (20% OSA adjustable). A control loop sensing the supply temperature shall modulate the heat/cool coil in heating mode, the OSA dampers and heat/cool coil valve in cooling mode in sequence to maintain a minimum supply air temperature of 52°(adjustable).
6. The supply air temperature may be reset up to 63°F from 52°F at the rate of .5 to 1°F (programmable) per 10 minutes based on the zone calling for the most cooling, or until any OR sub-cooling coil valve is at 90% open. Reset downward occurs when a zone has a cooling percentage above 90% and upward below 60% call for cooling. The software shall allow the User to exclude any zone from the poll (at start-up all zones shall be included in the poll).
7. A control loop sensing the return air relative humidity shall modulate the humidifiers to maintain the return air relative humidity set point of 30% RH minimum (adjustable). The controller shall monitor the supply duct high limit humidity sensor to ensure supply duct humidity does not exceed 90%.
8. On supply fan shut down the outside air and relief air dampers shall close, the return fan shall stop and the humidifier shall be locked out.
9. The OSA and return dampers in occupied mode modulate to control ventilation air flow rates across the outside air flow station. Return air CO_2 sensors located in the ductwork shall monitor CO_2 levels and report parts per million back to the BAS and increase the OSA minimum air flow set point linearly up to 50% with a change in return air CO_2 from 750 to 1,000 PPM. Once CO_2 level have been reduced to acceptable levels the OSA and return air dampers shall reset back to the minimum CFM settings or to a level to maintain building pressurization or economization.
10. Separate duct static sensors shall be located as required in low pressure return air systems upstream of ATC dampers providing duct pressure control. The ATC dampers shall modulate to maintain a 0.3 inched WC (adjustable) set point.

11. Penthouse Relief Air Dampers: The air-handlers are located in mechanical penthouses. The penthouse shall serve as a relief air plenum. A relief air damper will be provided with multiple motorized backdraft dampers (a minimum of 6-dampers per louver. See plans.) The penthouse relief dampers shall be staged open based on the amount of air being relieved. The controls contractor and T&B contractor shall work in unison to determine the amount of dampers that should open based on the amount of relief air. A suggested starting point is as follows:
    - Min Flow: 2 Dampers
    - 50% flow: 3 Dampers
    - 75% flow: 4 Dampers
    - 100% flow: 6 Dampers

12. Safety
    Discharge high static cutout, high negative static cutout, fire alarm interlock by Div. 26, smoke detectors in the supply and return air streams, and supply and return fan VFD fault alarms de-energize the supply and return fans upon activation. When the OAT is less than 45 degrees F (7 degrees C), the heating coil valve modulates to maintain the mixed air temperature at 45 degrees F (7 degrees C). When the OAT is 45 degrees F (7 degrees C) or above, the heating coil valve closes. The outside air and relief air dampers shall

close, all other dampers and valves position to their normal position after the fans are de-energized

5.2 OPERATING ROOM CONTROL

A. The operating room is controlled in occupied and unoccupied modes. Provide and install an occupancy sensor in each Operating Room. If the sensor does not detect occupancy for a 30-minute period, the room shall be set to unoccupied mode. The occupied status shall be displayed on the FMS console floor graphic.

B. In the occupied mode the system operates as follows:

1. The operating room is supplied and exhausted with a constant volume of air to meet ventilation, pressurization and thermal requirements. The room's pressurization is maintained by a fixed volumetric offset between the supply and exhaust air volumes. A local pressure monitor provides visual confirmation of status and audible and visual alarms if the room pressure is not as desired, tie this monitor into the BMS. Volumetric offset to be set to maintain a pressure differential of 0.02"(adjustable).

2. The occupied mode of each zone shall be in the occupied mode, the supply valve shall control to the occupied minimum ventilation setting in the dead and heating modes. Local controllers measuring the supply duct volumes and shall modulate the valve to maintain the minimum ventilation set points. The controller shall measure the exhaust flow rates and modulate the exhaust valve to maintain a programmed differential between the supply and exhaust. If the space temperature is below the heating set point the controller shall modulate the reheat coil valve. On an increase in temperature above the cooling set point the controller shall modulate the chilled water control valve and is subject to maximum cooling setting to maintain the space temperature cooling set point. The chilled water control valve shall go to a minimum flow before the hot water valve opens. The exhaust valve shall track the supply to maintain the pre-programmed differential flow rate.

3. In the unoccupied mode, the stand-by minimum airflow set points shall be 30%. The offset produces a positive pressure in the operating room relative to the corridor. The setpoint temperature is 72 degrees (adjustable).

4. Control of the space temperature shall be through space temperature control. The reheat coil valve shall modulate to maintain room air temperature set point. The discharge and space temperature shall be available for display at the FMS. The space temperature sensor set point dial shall determine the space temperature set point or can be overridden by the operator.

5. A room pressure monitor is installed next to the door entering the operating room. A room sensor and reference sensor in the adjoining space provide direct measurement pressure. The differential pressure monitor shall have an audible and visual alarm, key switch to disable the monitor, and a door switch input. An adjustable alarm delay prevents nuisance alarms caused by opening the door as well as a door switch interlock. This pressure monitor shall be tied into the BMS.

6. Auxiliary OR Cooling – On an additional call for cooling above that delivered by the central system, the air handler and air cooled chiller shall be modulated in unison subject

to a 42° discharge (adjustable) air flow limit to satisfy the space cooling set point.

7. There is no smoke control sensor or logic required for these operating rooms on this project.

C. On a call for dehumidification the air cooled chiller shall modulate to maintain a 42° coil discharge temperature by dropping the chilled water temperature as low as 38°.

D. Interlock the air cooled chiller to prevent operation if air flow is not sensed.

1. Temp Trak Remote Monitoring – Provide BMS tie in to the IHC Temp trak system. Coordinate with mechanical engineer and IHC facilities to accomplish this.

PART 6 - MISC. SEQUENCE OF OPERATION

6.1 HOT WATER PUMPS, P-1 and P-2

A. One heating pump shall run continuously.

B. A pressure loop measuring the hot water differential pressure remotely on the piping shall modulate the VFDs on P-1 and P-2 maintain set point. The pressure set point shall be reset upward when any zone heating reheat valve exceed 90% open. Initial reset ratio (programmable) shall be .35 psi per 10 minutes to a maximum of 10 psi. The pressure set point shall be reset downward when no zone valve is greater than 60% to a minimum of 2 psi using the same reset ratio.

C. Once the lead pump reaches the speed of 58 Hz for 10 minutes (adjustable) an additional pump shall be added to the operating pumps. When the speed of the pumps is below 50 Hz (adjustable) for 20 minutes the lag pump shall stop.

D. Rotate pumps monthly to equalize run time while also looking at total run hours of pumps to equalize.

6.4 HOT WATER HEAT EXCHANGERS

A. The building contains a hot water to glycol hot water converter for the air handlers pre-heat coils.

B. Glycol Hot Water System - The glycol hot water heating is accomplished via a plate & frame heater exchanger.

C. The system operates as follows (All suggested set points and settings are adjustable.):

The glycol control valve shall be interlocked with the SOURCE heating pumps, P-3 & P-4, and VFDs to modulate on a call for heat. Pumps alternate to equalize equipment runtime. Selection of the primary & standby pump is evaluated on a weekly basis. The pump with the least runtime is the primary. The remaining pump is standby.

When there is a call for heating from the new AHU-2, pump P-9 or pump P-10 will enable to provide glycol heating water flow through the heating coil. Pumps P-9 and P-10 are 100% redundant. There should never be a time when both pumps are running.

D. Glycol Heating Control

The glycol heating system enable point is controlled either manually by the operator or by a program function (i.e., OSA temperature, Time-Of-Day). If the heating system enable point is on and the outdoor air temperature is below 50 degrees F., the lead hot water pump starts. The variable frequency drive modulates pump speed to maintain system differential pressure of 15 PSI (adjustable) as sensed near the end of the hot water piping run.

At proof of flow, the glycol hot water control valve operates. The glycol supply hot water set point is maintained by modulating the converter valves. The hot water supply set point is reset based on outdoor air temperature. When the outdoor air temperature is 0 degrees F, the set point is 120 degrees F (adj.) and when the outdoor air temperature is 55 degrees F, the set point is 100 degrees F (adj.).

If the primary pump fails, an alarm is generated and the standby pump starts. If both of the pumps fail, the hot water valve closes and a critical building alarm is generated.

The DDC system uses VFD communication to BAS to confirm the pumps are in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

6.6 RO WATER TREATMENT STATIONS

A. These systems operate from factory controls. Monitor the units for operational status via the contacts provided with the equipment. Assume 4 digital outputs per station.

6.7 GLYCOL MAKEUP UNITS:

A. These units have a pressure switch located on the glycol system to measure the system pressure as well as a makeup valve for each system and a mixing tank and pump with tank level control. On a fall in system pressure, the BMS is alarmed. Upon pushing the local button, the glycol feed pump starts to provide makeup glycol to the system. The BMS system monitors a call for manual glycol makeup as well as a low level alarm on the glycol fill tank.

6.8 BUILDING ENERGY GRAPHICAL USER INTERFACE

A. All metered trend data and power usage should be displayed to the graphical user interface (GUI) of the building management system. The GUI shall be a separate page on the controls graphics that can be access from the home page of the building automation system. This page shall display at a minimum the following information.

B. Building energy usage for both electrical consumption and natural gas, with Electrical usage shall be displayed in (kWh) and-natural gas displayed in (Decatherms). This display will provide data in 15 minute intervals and up to 3 years history.

C. Cooling System usage (MBTU).

D. Boiler System energy usage (MBTU).

E. Fan efficiency per air handler. This shall be displayed in (kW/CFM).

6.9 HYDRONIC UNIT HEATER

A. Unit heater is to operate on call for heat. Heater to cycle on call for heat when space temperature is below 60° (adjustable). Unit heater to be controlled with wall mounted thermostat. Thermostat shall report temperature to BMS. Provide low temperature alarm.

6.10 EXHAUST FAN CONTROL

A. The exhaust fan shall be interlocked to operate whenever the washer is operating and for 1 hour thereafter.

6.11 AIR TO WATER HEAT PUMP

A. This building will have an outdoor air to water heat pumps mounted on the roof. The heat pumps will run whenever there is a call for cooling or heating with the lead heat pump rotated for equal runtimes. The three heat pumps are each sized for 50% of the building cooling load for N+1 redundancy.

B. Each heat pump is served by a single primary pump which is enabled with its respective heat pump.

C. Each heat pump is served by two heating water secondary pumps and two chilled water secondary pumps. Each pump is sized for 50% of the total load. All secondary pumps are piped so that any two pumps can serve any heat pump with ATC valves sequenced for isolation and .

D. The heat pumps shall be staged based on their own factory controls. Monitor via a BacNet interface. Provide points list to Facility Engineer for selection of point to be integrated into the BMS. The heat pumps provide year around cooling when cooling is required and requested for comfort and operating room sub-cooling and building dehumidification needs. The chilled water set point shall be reset by the air handler call for cooling. There is also a sub cooling setpoint for dehumidification in the operating rooms. If the relative humidity in a single Operating Room is over 50% (adjustable) then the chilled water delivery temperature shall be reset down to 38-degree F. The heat pumps also provide summertime reheat and the first stage of winter heating with the balance of the heating from the gas-fired boilers.

E. The new chiller module does not have free-cooling capability. The existing section has ample free-cooling capacity to serve the existing and building expansion during winter conditions.

F. If third party economizer is added to the chiller it must be controlled by the chiller's factory control. Not under this division of work.

Points List

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooing Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
AIR HANDLERS																										
Supply Fan Return/ VFD (Points per VFD)						X					X		X	X	X		X									
Fan Start/Stop		X				X							X													
Fan Status	X					X	X							X				X					X			
Fan Signal				X				X		X	X			X												X
Discharge Air Static Pressure			X					X			X	X			X	X	X	X						X		X
Low Temp Sensor (Freeze Stat)	X				X	X	X				X	X		X	X			X	X			X	X			X
Smoke Detectors - Supply Air/Return Air	X	X				X	X				X			X	X			X	X			X	X			X
Pre-Filter Differential Pressure			X					X			X	X			X		X	X	X							X
Final Filter Differential Pressure			X					X			X	X			X		X	X	X							X
Return Air CO2 Sensor			X					X			X	X			X	X		X								X
Building Static Pressure			X								X				X											X

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
Outside Supply Air Flow Station			X					X			X		X	X	X		X									X
Supply Air Flow Station			X					X			X		X	X	X		X						X		X	
Return Air Flow Station			X					X			X		X	X	X		X						X		X	
High Static Pressure Switch	X				X	X	X				X	X		X	X			X	X			X	X			X
Outside Air Damper				X				X			X				X	X										X
Return Air Damper				X				X			X				X	X										X
Relief Air Damper				X				X			X				X	X										X
Supply Air Temperature, Humidity and Dew Point			X					X			X				X		X	X								X
Return Air Temperature and Humidity and Dew Point			X					X			X				X		X	X								X
Cooling Coil Valve				X				X	X	X	X	X		X	X	X										X
Heating Coil Valve				X				X		X	X			X	X	X										X
Heating Coil Discharge Air Temperature			X					X			X				X		X	X								X

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooing Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
Humidifier				X	X	X		X			X				X											X
Supply Duct Pressure		X									X		X													
Return Fan Suction Pressure			X					X			X				X			X		X						X
Return Fan Discharge Pressure		X									X		X													
Mixed Air Temp			X					X			X				X		X	X								X
All VFD's (as available in VFD)																										
Start/Stop		X				X							X													
Status	X					X	X							X			X					X				
System Fault						X	X										X	X								
Speed				X		X		X							X										X	
Frequency Output				X		X									X											
Percent Output				X		X									X											
Current			X			X									X											
Torque			X			X									X											
Power			X			X									X								X			
Drive Temperature			X			X									X											
KWH			X			X									X										X	X
Runtime			X			X									X							X				
DC Bus Volts			X			X									X											

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
PID Feedback			X			X																				
Fault 1	X					X	X											X	X	X					X	
Fault 2	X					X	X											X	X	X					X	
Emergency Generator Load Shed		X																								
VAV BOX REHEAT																										
Space temperature			X					X							X									X		
Space temperature setpoint				X											X	X										
Supply air temperature			X					X							X									X		
Damper position			X					X							X											
Reheat output value	`			X				X							X											
Controlling cooling setpoint				X											X	X										
Controlling heating setpoint				X											X	X										
Controlling maximum flow setpoint				X											X	X										
Control minimum flow setpoint				X											X	X										
Current airflow (cfm)			X												X									X		

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
Occupied/Unoccupied schedule status	X														X	X										
Current control mode description			X												X											
Control Heating Max Flow Setpoint											X				X	X										
CO_2			X												X			X							X	
CO_2 Ventilation Set Point						X									X			X							X	
BUILDING HEATING WATER SYSTEM																										
Hot Water System Enable (each)		X			X		X				X		X	X				X	X			X				X
Hot Water System Status (each)	X				X		X				X		X	X				X	X			X	X			X
Heating Pumps Stop/Start (each)		X									X															
Heating Pumps Status (each)	X										X						X	X	X							
VFD Signal				X				X		X	X			X	X								X			X
Hot Water Differential Pressure			X								X				X	X										X
Supply Water Temperature			X					X			X				X	X		X	X	X						X

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooing Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
Return Water Temperature			X					X			X				X											X
Flow Rate						X	X				X	X			X	X								X		
GLYCOL PREHEAT SYSTEM																										
Pre-Heat System Enable (each)		X			X		X				X		X	X				X	X			X				X
Pre-Heat System Status (each)	X				X		X				X		X	X				X	X			X	X			X
Heating Pumps Stop/Start (each)		X									X															
Heating Pumps Status (each)	X										X						X	X	X				X			
VFD Signal				X				X		X	X			X	X											X
Glycol Low Level			X								X				X	X										X
Pre-Heat Loop Supply Water Temperature			X																							X
Pre-Heat Loop Return Water Temperature			X																							X
Control Valve				X				X			X				X	X		X	X	X						X
HX Set Point						X	X				X	X			X	X								X		
Pre-Heat Loop Water Differential Pressure				X							X				X	X										X

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
CHILLED WATER SYSTEM																										
Chilled Water Pumps Enable (each)		X			X		X				X		X	X		X	X	X	X						X	X
Chilled Water Pumps Status (each)	X				X		X				X	X		X	X		X	X	X			X	X			
Chilled Water Flow Each Chiller			X		X			X			X				X								**X**	**X**		
Building Chilled Water Supply Temp			X		X			X			X	X		X	X	X										X
Building Chilled Water Return Temp			X		X			X			X	X		X	X	X										X
Isolation Valves		X		X							X		X	X	X											
Differential Pressure			X												X											
Building Chilled Water Flow			X															X		X					X	
ALL CHILLERS																										
Status						X		X			X															
Alarm						X		X			X								X	X						
% Load						X		X			X															
Signal Input						X		X			X															
Demand Limiting						X		X			X															

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooing Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
Entering & Leaving Water Temp on Condenser & Evaporator						X		X			X															
Oil Temperature						X		X			X															
Vane Position if Applicable						X		X			X															
Motor Speed						X		X			X															
Evaporator Pressure						X		X			X															
Evaporator Temperature						X		X			X															
Condenser Pressure						X		X			X															
Condenser Temperature						X		X			X															
Emergency Shutdown																										
Condenser Delta P																										
CHILLED WATER PUMPS																										
Stop/Start		X									X		X													
Status	X							X			X			X				X	X							
VFD				X		X					X															
CONDENSING BOILERS																										

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooing Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
Status						X					X															
Alarm						X					X							X	X	X						
Firing Rate						X					X															
EWT & LWT						X					X															
Combustion Fan (if VFD gets speed & status & kwh)						X					X															
Gas Consumption	X										X												X			
Isolation Valve		X									X															
Hot Water Bypass Valve		X									X															
Emergency Shutdown	X																									
Combustion Damper End Switch	X										X															
ALL PUMP VFD																										
Status					X						X															
Fault					X						X							X	X	X						
Speed					X						X															
% Output					X						X															
Amperage In & Out					X						X															
KWH					X						X												X			
Voltage In & Out					X																					

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
Signal Input					X						X															
Hertz					X						X															
IT RM COOLING																										
CHW Supply Temperature			X								X				X											
CHW Return Temperature			X								X				X											
Sample Space Temperature			X								X				X			X	X	X						
RO SYSTEM (TYPICAL)																										
Status	X										X															
Alarm/Fault	X										X							X	X	X						
Alarm											X															
Maintenance	X										X															
DOMESTIC WATER RECIRC PUMPS																										
Pump Start/Stop		X									X		X													
Pump Status	X										X			X				X					X			
GENERAL EXHAUST FAN																										
Fan Start/Stop		X				X					X		X					X	X	X						
Fan Status	X					X	X				X			X				X	X				X			
Duct and Filter Pressure Drop			X			X									X											

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
Where Applicable																										
EMERGENCY EXHAUST FAN																										
Fan Start/Stop		X				X					X		X													
Fan Status	X					X	X				X			X				X	X	X			X			
VENTURI VALVE TRACKING PAIRS																										
Space Temperature Sensor Input			X			X					X				X			X								X
Occupied Temperature Set Point Input			X			X					X				X	X										
Occupancy Override Input	X					X					X			X												
Occupancy Sensor Input	X					X								X												
Unoccupied Cooling Temperature Set Point						X																				
Unoccupied Heating Temperature Set Point						X										X										
Discharge Air Temperature Input			X			X					X				X	X										X
Terminal Load Output						X			X	X	X				X											

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
BMS HVAC Emergency Override Input	X					X								X												
Zone Total Supply Flow Output			X			X					X				X											
Zone Total Exhaust Flow Output			X			X					X				X											
Zone Volumetric Offset Feedback Output			X			X					X				X											
~~**DOOR SWITCH**~~																										
Supply Valve Flow Feedback Output			X			X					X				X											
Exhaust Valve Flow Feedback output			X			X					X				X											
Reheat Valve										X	X				X											X
Differential Pressure Across Each Venturi Valve			X								X				X			X	X							
GLYCOL MAKEUP SYSTEM																										
Low Level Alarm	X										X			X				X								X
Pump Status	X										X			X				X					X			X

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooing Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
System Pressure			X					X			X							X								X
EMERGENCY GENERATOR TRANSFER SWITCH																										
Generator Status	X				X	X								X				X	X	X						X
Transfer Switch Status	X				X	X								X				X	X	X						X
POWER CONSUMPTION																										
Electrical Power Meters - deleted																										
COMPRESSOR & VACUUM PUMPS																										
Alarm	X										X			X												
Pump Status	X										X				X											
Pump Pressure			X								X				X			X	X							X
Deoxidizer Alarm	X										X				X			X	X							X
BUILDING WATER FLOW METERS																										
Domestic Water															X		X						X			
Domestic Soft Water	X						X								X		X						X			
Water Sub-meter	X						X								X								X			

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooing Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
Entire Facility																										
Domestic Cold Water	X										X				X		X						X			
MAKE-UP-WATER																										
Heating Hot Water Systems	X		**X**								X				X		X	X	X	X			X			
Humidifier	X		**X**								X				X		X						X			
Domestic Water Heaters Cold Water Supply	X		**X**								X				X		X						X			
DOMESTIC WATER HEATER																										
Supply Water Temperature						X												X		X		X				
Valve Positioning						X																				
Com Failure						X																				
ENERGY METERS																										
See sequence of operation						X					X				X		X						X			
IRRIGATION WATER																										
Outdoor Irrigation systems	X		**X**								X				X		X						X			
GENERATOR																										
Points determined by						X	X	X																		

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooing Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
Generator manufacturer																										
Fuel Oil Monitoring	**X**						X	X																		
MEDICAL GAS STORAGE RM EXHAUST																										
Fan Start/Stop		X				X						X														
Fan Status	X					X		X				X						X	X	X			X			
Glycol Snow Melt System																										
Stop/Start		X									X			X				X		X						
Leaving Water Temp			X								X				X			X	X							X
Entering Water Temp			X								X				X			X	X							X
Control Valve				X							X				X	X										X
Snow Sensor			X					X				X			X			X		X						X
Pump Start/Stop		X									X			X				X		X						
Pump Status	X							X			X						X	X	X	X			X			
Power Consumption																										
See M&V - deleted																										
Electrical Power Meters - deleted																										
KW - deleted																										
PF - deleted																										

	Input / Output						Web Pages Graphics										Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooing Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples
KWH - deleted																										
Volt - deleted																										
Amperage - deleted																										
Total Harmonic Distortion (main Meter only) & supplied by 26000							X								X									X		
Gas and water Meters																										
Building Meter	X		**X**				X								X								X			
Water Sub-meter	X		**X**				X								X								X			
Automatic Transfer Switches																										
Switch Status	X					X		X										X		X			X			
Additional points determined by ATS manufacturer						X																				
OPERATING ROOM																										
Pressure Monitors						X	X				X				X			X	X	X		X				X
Occupancy Sensors – Dual type, Heat and Motion	**X**					X	X				X				X			X	X	X		X				X

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples

	Input / Output						Web Pages Graphics											Alarms					Trends Archive Size Verify w/Owner			
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Run Time Totalize or Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Change of Value / 800 Samples	Change of Value / 30 Samples

END OF SECTION 230900

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 231123

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Mechanical sleeve seals.
7. Grout.
8. Concrete bases.
9. This division is to pay all costs associated with the gas meter that are required by the local gas company/authority.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 2 psig but not more than 5 psig, and is reduced to secondary pressure of more than 0.5 psig but not more than 2 psig.

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.
4. Dielectric fittings.
5. Dielectric fittings.
6. Mechanical sleeve seals.
7. Escutcheons.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

D. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

E. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

F. Qualification Data: For qualified professional engineer.

G. Welding certificates.

H. Field quality-control reports.

I. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

   a. Material Group: 1.1.
   b. End Connections: Threaded or butt welding to match pipe.
   c. Lapped Face: Not permitted underground.
   d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
   e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

B. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
    c. Aboveground Portion: PE transition fitting.
    d. Outlet shall be threaded or flanged or suitable for welded connection.
    e. Tracer wire connection.
    f. Ultraviolet shield.
    g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    b. Outlet shall be threaded or flanged or suitable for welded connection.
    c. Bridging sleeve over mechanical coupling.
    d. Factory-connected anode.
    e. Tracer wire connection.
    f. Ultraviolet shield.
    g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

5. Plastic Mechanical Couplings,NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Lyall, R. W. & Company, Inc.
        2) Mueller Co.; Gas Products Div.
        3) Perfection Corporation; a subsidiary of American Meter Company.

    b. PE body with molded-in, stainless-steel support ring.
    c. Buna-nitrile seals.
    d. Acetal collets.
    e. Electro-zinc-plated steel stiffener.

6. Plastic Mechanical Couplings,NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Lyall, R. W. & Company, Inc.
        2) Mueller Co.; Gas Products Div.

3) Perfection Corporation; a subsidiary of American Meter Company.

b. Fiber-reinforced plastic body.
c. PE body tube.
d. Buna-nitrile seals.
e. Acetal collets.
f. Stainless-steel bolts, nuts, and washers.

7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Dresser Piping Specialties; Division of Dresser, Inc.
2) Smith-Blair, Inc.

b. Stainless-steel flanges and tube with epoxy finish.
c. Buna-nitrile seals.
d. Stainless-steel bolts, washers, and nuts.
e. Factory-installed anode for steel-body couplings installed underground.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches.

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: [40] [60]-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:

   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Lee Brass Company.
   b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

   a. McDonald, A. Y. Mfg. Co.
   b. Mueller Co.; Gas Products Div.
   c. Xomox Corporation; a Crane company.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flowserve.
   b. Homestead Valve; a division of Olson Technologies, Inc.
   c. McDonald, A. Y. Mfg. Co.
   d. Milliken Valve Company.
   e. Mueller Co.; Gas Products Div.
   f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements,provide products by one of the following

   a. Vanguard Valves, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 5 psig.
4. Cast-aluminum body with nickel-plated chrome steel internal parts.
5. Nitrile-rubber valve washer.
6. Sight windows for visual indication of valve position.
7. Threaded end connections complying with ASME B1.20.1.
8. Wall mounting bracket with bubble level indicator.

B. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Pacific Seismic Products, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: [0.5 psig] [7 psig] [60 psig].
4. Cast-aluminum body with stainless-steel internal parts.
5. Nitrile-rubber, reset-stem o-ring seal.
6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.
9. End Connections: Threaded for valves NPS 2 and smaller; flanged for valves NPS 2-1/2 and larger.

2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Actaris.
   b. American Meter Company.
   c. Eclipse Combustion, Inc.
   d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   e. Invensys.
   f. Maxitrol Company.
   g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.

11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 5 psig.

2.7 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
   f. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Advance Products & Systems, Inc.
   b. Calpico Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Companion-flange assembly for field assembly.
4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.8 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.9 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
3. Pressure Plates: Stainless steel.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.10 ESCUTCHEONS

A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.

B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Escutcheons: With set screw.

1. Finish: Polished chrome-plated or rough brass.

D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.

1. Finish: Polished chrome-plated or rough brass.

E. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.11 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

2.12 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Install fittings for changes in direction and branch connections.

E. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install escutcheons at penetrations of interior walls, ceilings, and floors.

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
c. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
d. Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
e. Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
f. Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
g. Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw or spring clips.
h. Piping in Equipment Rooms: One-piece, cast-brass type.
i. Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
j. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

M. Verify final equipment locations for roughing-in.

N. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

O. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

P. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

Q. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

R. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

    b. Do not install natural-gas piping in solid walls or partitions.

S. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

T. Connect branch piping from top or side of horizontal piping.

U. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each

piece of equipment. Unions are not required at flanged connections.

V. Do not use natural-gas piping as grounding electrode.

W. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

X. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

D. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

E. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (semigloss).

d. Color: Gray.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Quick-drying alkyd metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex (flat).
d. Color: Gray.

2. Alkyd System: MPI INT 5.1E.

a. Prime Coat: Quick-drying alkyd metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (flat).
d. Color: Gray.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Use 3000-psig 28-day, compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.14 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:

1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

3.15 INDOOR PIPING SCHEDULE

A. Aboveground, piping NPS 2 and smaller shall be the following:

1. Steel pipe with wrought-steel fittings and welded or threaded joints.

B. Aboveground, piping NPS 2-1/2” and larger shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints in a vented conduit.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.16 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. Bronze plug valve.
2. Cast-iron, nonlubricated plug valve.

END OF SECTION 231123

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 232113

HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Makeup-water piping.
4. Condensate-drain piping.
5. Air-vent piping.
6. Dielectric fittings.

1.3 SEISMIC REQUIREMENTS

A. All other components shall be assigned a component importance factor, I*p*, equal to 1.0.

B. Seismic Performance: Pipe hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."

1. For piping with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. For piping with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Steel pipe and fittings.
2. Copper pipe, tubing and fittings.
3. Dielectric fittings.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components.
2. Other building services.
3. Structural members.

B. Qualification Data: For Installer.

C. Welding certificates.

D. Field quality-control reports: Written reports as specified in Part 3 of this section including:
1. Test procedures used.
2. Test results showing compliance with specified requirements.
3. Failed test results with corrective action taken to achieve compliance with specified requirements.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.7 COORDINATION

A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

D. Coordinate pipe fitting pressure classes with products specified in related sections.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.

1. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.

2. Grooved-End-Tube Couplings: Coupling housings shall be cast with offsetting, angle-pattern bolt pads to provide joint rigidity and support and hanging in accordance with ANSI B31.1 and B31.9. Ductile-iron housing with keys matching pipe and fitting grooves, EPDM gasket rated for minimum 230 deg F without use of special lubricants. For use with housing, and ASTM A449 electroplated steel nuts and bolts.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.

2. End Connections: Butt welding.

3. Facings: Raised face.

H. Forged Steel “Olet” Type Fittings, Welding, Socket-Welding and Threaded: ASME B16.11 and ASTM A105.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

J. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following:

a. Victaulic Company.

b. Anvil International, Inc.

c. Tyco-Grinnel

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 53, Type F, E, or S, Grade B factory-fabricated steel; or ASTM A 234, Grade WPB steel fittings with grooves or shoulders designed and constructed to accept grooved-end couplings.

3. Couplings: Two Ductile- housing and synthetic rubber gasket of central cavity pressure-responsive design; with ASTM A449 electroplated steel nuts and bolts to secure grooved

pipe and fittings. Couplings shall comply with ASTM F1476 Standard Specification for the Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

a. Rigid Type: Coupling housings shall be cast with offsetting, angle-pattern bolt pads to provide joint rigidity and support and hanging in accordance with ANSI B31.1 and B31.9.

b. Gasket: High temperature EPDM gasket, suitable for water service to +250 deg F, without use of special lubricants.

c. Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for the elimination of flexible connectors.

d. 14” and Larger: Two –segment coupling, with lead-in chamfer on housing key and a wide-width gasket having a center-leg.

4. Combinations of grooved mechanical-joint couplings and short nipples may also be used.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. PP (Polypropylene) Pipe: ASTM F 2389, SDR 9.0 and fiberglass composite reinforced SDR 11.

1. PP Fusion-weld Socket Fittings: ASTM F 2389.

G.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

1. Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.Capitol Manufacturing Co.

c. Capitol Manufacturing Company.

d. Central Plastics Company.

e. Elster Perfection.

f. Grinnell Mechanical Products.

g. Matco-Norca.

h. Pipeline Seal and Insulator, Inc.

i. Precision Plumbing Products, Inc.

j. Victaulic Company.

k. Watts Regulator Co.

l. Zurn Industries, LLC.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. End Connections: Threaded, or flanged.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples or Waterways: Electroplated steel with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller shall be any of the following:

1. Type L drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

2. Schedule 40, Grade B, Type 96 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

2. Schedule 40, Grade B, Type 96 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

E. Glycol cooling-water piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

2. Schedule 40, Grade B, Type 96 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

F. Glycol cooling-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

G. Glycol cooling-water piping, belowground, NPS 2-1/2 and larger, shall be any of the following:

1. **SD 9.0 PP pipe with PP fusion socket fittings and fusion joints or butt-fusion joints.**

H. Makeup-water piping installed aboveground shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

I. Condensate-drain piping shall be the following:

1. Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

J. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

K. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

L. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. PRE-WORK / PRE-REQUISITES

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. The Contractor shall study the architectural, structural, mechanical, electrical and other drawings to eliminate conflict of piping with other structure lighting or other services.

B. CONDITION

1. All installed pipe lines shall be free from dents, scars, and burrs, with ends reamed smooth.
2. All piping shall be clean and free from acids and loose dirt when installed and shall be kept clean during the completion of the installation.
3. Install piping free of sags and bends.
4. All installed pipe lines shall remain straight against strains tending to cause distortion during system operation. The contractor shall make proper allowance for pipe line expansion and contraction so that no unsightly distortion, noise, damage or improper operation results therefrom.

C. SELECTION

1. Select system components with pressure rating equal to or greater than system operating pressure.
2. No street type fittings shall be used.
3. No short nipples shall be used except at drain valves.
4. Plugs of rags, wools, cottons, waste, or similar materials may not be used for plugging.

D. ROUTING/ARRANGEMENT

1. Piping installations shall be neatly organized.

2. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
3. Install groups of pipes parallel to each other.
4. Install piping spaced to permit application of insulation.
5. Install piping parallel and spaced to permit the servicing of valves.
6. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls or axis of the building.
7. Diagonal runs are prohibited unless specifically indicated otherwise.
8. Install fittings for all changes in direction.
9. No piping shall be run above any electrical panels, electrical equipment or access clearances for electrical for electrical panels or equipment. No piping shall be allowed to run through any electrical rooms.
10. Piping shall be arranged, placed and installed to facilitate equipment maintenance and shall be so arranged to not interfere with the installation of the air-conditioning equipment, ducts, or the removal of other equipment or devices. All specialties shall be so placed to permit easy operation and access.
11. All piping shall be so installed to insure noiseless circulation.
12. Install fittings for all branch connections.
13. Unless otherwise indicated, install branch connections to mains using [mechanically formed] tee fittings or forged steel branch fittings in main pipe, with the branch connected to the bottom of the main pipe.
14. For up-feed risers, connect the branch to the top of the main pipe.
15. Forged branch fittings shall be installed per the manufacturer's recommendations.

E. ACCESS / ARRANGEMENT

1. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. All piping shall be so arranged to not block access to manholes, access openings, etc.
2. Install piping at indicated slopes. If not indicated, install piping at a uniform grade of 0.2 percent where possible, upward in direction of flow. Traps are to be avoided where-ever possible.
3. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
4. When insulated pipes are supported by a roller hanger they shall be protected from damage by suitable pipe covering protection saddles. Saddles shall support pipe on roller and shall be packed with insulation.
5. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
6. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, at each coil on all sides of automatic valves where valves do not have union connections, elsewhere as indicated, and wherever necessary to prevent undue difficulty in making repairs or replacement. Unions are not required at flanged connections.
7. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated. Install flanges on valves, apparatus, and equipment having 2 ½ inch NPS and larger connections. Flanges or unions as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment.
8. Install shutoff valve immediately upstream of each dielectric fitting. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

9. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides. Anchor piping for proper direction of expansion and contraction.
10. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
11. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
12. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."
13. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS ¾) nipple and ball valve in blow-down connection of strainers NPS 2) and larger. Match size of strainer blow-off connection for strainers smaller than NPS 2).
14. Install flexible connectors at inlet and discharge connections to pumps (except inline pumps) and other vibration-producing equipment.
15. Polypropylene pipe in or passing through plenums must be fire wrapped or installed in a metal conduit.

F. DRAINAGE

1. Drain valves shall be installed at all low points in all piping systems to allow for complete drainage of piping systems.
2. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
3. All piping systems shall be installed so that they can be easily drained by means of drainage of low points of all piping without disconnecting pipe.
4. If not specifically indicated on the drawings, the frequency of draining shall determine whether drain caps, plugs, cocks, or valves are to be used.

G. IDENTIFICATION

1. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

3.3 DIELECTRIC FITTING INSTALLATION

A. Make connections according to the following, unless otherwise indicated:

1. Install dielectric nipples or waterways in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install waterways, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install Dielectric Fittings into Hydronic Piping Systems: Install dielectric nipples, waterways or couplings to connect piping materials of dissimilar metals.
4. End Connections: Threaded, or flanged.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Steel roof deck shall not be used to support loads from piping, ductwork or equipment, unless noted otherwise. Hanger loads less than 50 lbs. may be hung from the steel roof deck in cases when hanging from the steel roof deck cannot be avoided; the attachment method must distribute the load across the deck as approved by the Structural Engineer.

D. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

E. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
6. NPS 3 and Larger: Maximum span, 12 feet; minimum rod size, 1/2 inch.

F. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

G. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

H. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

I. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts.

1. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

2. Installed in accordance with the manufacturer’s written recommendations.

3. Ends shall be clean and free from indentations, projections or roll marks.

4. The gasket shall be molded and produced by the coupling manufacturer of an elastomer suitable for the intended service.

5. Unions and flanges for servicing and disconnect are not required in installations using grooved joint couplings.

6. Training: The coupling manufacturer’s factory-direct trained representative shall provide on-site training for the contractor’s field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed. The distributor’s representative will not be acceptable.

I. PP Fusion Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM D2657 and the manufacturer’s recommendations.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 232116

HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Makeup-water piping.
4. Condensate-drain piping.
5. Air-vent piping.
6. Steel, hydronic buffer tanks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 VALVES

A. Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping. Gate valves are not allowed on this project.

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230900 "Instrumentation and Control for HVAC.

C. Refer to Part 3 “Valve Applications” Article for applications of each valve.

D. Bronze, Calibrated-Orifice or Venturi, Balancing Valves, NPS 2 and smaller:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump.
   c. Flow Design Inc.
   d. Gerand Engineering Co.
   e. Griswold Controls.
   f. Taco.
   g. Tour & Andersson; available through Victaulic Company.
   h. Tyco-Grinnell
2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

E. Cast-Iron or Steel, Calibrated-Orifice or Venturi, Balancing Valves, NPS 2 ½ and larger:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Flow Design Inc.
   e. Gerand Engineering Co.
   f. Grinnell.
   g. Griswold Controls.
   h. Taco.
   i. Tour & Andersson; available through Victaulic Company.
   j. Spence Engineering Company Inc.
   k. Watts Regulator Co.
2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.

9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

F. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Conbraco Industries, Inc.
   e. Spence Engineering Company, Inc.
   f. Watts Regulator Co.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: Brass, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Diaphragm-Operated Safety Valves: ASME labeled.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Conbraco Industries, Inc.
   e. Kunkle.
   f. Spence Engineering Company, Inc.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Brass, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.

10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

H. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump.
   c. Flow Design Inc.
   d. Griswold Controls.
   e. Taco
2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Tamper proof, self-cleaning, and removable, for inspections and replacement.
   a. Corrosion resistant.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Attached by chain and marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations:
   a. Minimum CWP Rating: 175 psig.
8. Maximum Operating Temperature: 200 deg F.
9. Fitted with pressure and temperature test valves.
10. Equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case.

2.2 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Taco, Inc.
   e. Titan Flow Control.
2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Manually operated with ball valve in the down position.
6. Inlet Connection: NPS 1/2.
7. Discharge Connection: NPS 1/8.

8. CWP Rating: 150 psig.
9. Maximum Operating Temperature: 225 deg F.

B. Automatic Air Vents:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amtrol, Inc.
   b. Bell & Gossett Domestic Pump.
   c. Hoffman Specialty ITT; Fluid Handling Div.
   d. Spirax-Sarco.
   e. Spirovent.
   f. Taco, Inc.
   g. Honeywell-Baukman.
2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/4.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 240 deg F.

C. Bladder -Type Expansion Tanks:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Taco, Inc.
   e. Zilmet
2. Tank: Welded steel, rated for 125-psig working pressure and 240 deg F maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Bladder : Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.
5. Access: Drain fitting and taps for pressure gage.
6. Support:
   a. Vertical tanks with steel legs or base.
   b. Horizontal tanks with steel saddles.

D. Tangential-Type Air Separators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amtrol, Inc.

b. Armstrong Pumps, Inc.

c. Bell & Gossett Domestic Pump.

d. Taco, Inc.

2. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 240 deg F maximum operating temperature.

3. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.

4. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.

5. Blowdown Connection: Threaded.

6. Size: Match system flow capacity.

2.3 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong Machine Works.

b. Hoffman Specialty ITT; Fluid Handling Div.

c. Metraflex Co.

d. Mueller

e. Spirax Sarco.

f. Trane Co.

g. Tyco-Grinnell.

h. Tour & Andersson; available through Victaulic Company.

i. Watts Regulator Co.

2. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.

3. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

4. Strainer Screen: Stainless-steel, or perforated stainless-steel basket:

a. 20-mesh strainer.

5. CWP Rating: 125 psig.

B. Basket Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.

b. Metraflex Co.

c. Mueller

d. Spirax Sarco.

e. Tyco-Grinnell.

f. Tour & Andersson; available through Victaulic Company.

2. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.

3. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
4. Strainer Screen: Perforated stainless-steel basket with 50 percent free area:
   a. 40-mesh startup strainer.
5. CWP Rating: 125 psig.

C. Stainless-Steel Braided-Corrugated, Flexible Connectors:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amber-Booth.
   b. Mason Industries.
   c. Metraflex Co.
   d. Flex-Weld.
   e. Fugate.
   f. Twin City Hose.
2. Body: 321 Stainless-steel close pitch corrugated hose with woven, flexible, 304 Stainless-steel, protective jacket.
3. End Connections: Flanged, ANSI Class 150 carbon steel
4. Performance: Permanent Offset; 3/8 inch, Intermittent Offset; 1/8 inch.
5. Safe Working Pressure: 175 psig. (For 8 inch diameter)
6. Maximum Operating Temperature: 200 deg F. (For 8 inch diameter)

D. Spherical, Rubber, Flexible Connectors:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amber-Booth.
   b. Mason Industries.
   c. Metraflex Co.
   d. Flex-Weld.
   e. Proco.
   f. Fugate.
   g. Twin City Hose.
2. Body: Double-sphere fiber-reinforced EPDM rubber body.
3. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
4. Performance: Capable of misalignment.
5. CWP Rating: 150 psig.
6. Maximum Operating Temperature: 250 deg F.

E. Diverting Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.

c. Bell & Gossett Domestic Pump.

d. Taco, Inc.

2. Body: Cast Iron or Wrought Copper
3. Ends: Threaded or Soldered
4. Flow Direction: Indicated on fitting.
5. CWP Rating: 125 psig.
6. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shut off-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Automatic air vents may cause damage to ceilings and other finished surfaces. Air vents aid in system filling. Air removal after initial startup is accomplished by air separator or boiler diptube. Manual air vents may be a better solution.

C. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

D. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

E. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

F. Install tangential air separator in pump suction. Install blowdown piping with full-port ball valve; extend full size to nearest floor drain.

G. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

H. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

I. Install buffer tanks on the floor per manufacturer's instructions.

END OF SECTION 232116

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 232123

HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Close-coupled, in-line centrifugal pumps.
2. Close-coupled, end-suction centrifugal pumps.
3. Separately coupled, horizontally mounted, in-line centrifugal pumps.
4. Separately coupled, vertically mounted, in-line centrifugal pumps.
5. Separately coupled, base-mounted, end-suction centrifugal pumps.
6. Separately coupled, base-mounted, double-suction centrifugal pumps.
7. Separately coupled, vertically mounted, double-suction centrifugal pumps.
8. Separately coupled, vertically mounted, turbine centrifugal pumps.
9. Wet-rotor pumps.
10. Automatic condensate pump units.

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of pump. Include certified performance curves and rated capacities, shipping weights, installed weights, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: For each pump.

1. Show pump layout and connections.
2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
3. Include diagrams for power, signal, and control wiring.

    a. Detail all wiring systems and differentiate clearly between manufacturer-installed and field-installed wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.

B. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on the specific types and models indicated. Other manufacturers' pumps with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

C. Regulatory Requirements: Fabricate and test steam condensate pumps to comply with HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation," and HI 1.6, "Centrifugal Pump Tests."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.8 COORDINATION

A. Coordinate size and location of concrete bases.

PART 2 - PRODUCTS

2.1 FACTORY STOCK CIRCULATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. Crane Pumps & Systems.

4. Flofab
5. Flowserve Corporation.
6. Grundfos Pumps Corporation.
7. ITT Corporation; Bell & Gossett.
8. Mepco, LLC.
9. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
10. Peerless Pump Company.
11. TACO Incorporated.
12. Thrush Company Inc.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, in-line or motor mounted pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rated for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded or threaded companion-flange or union-end connections or unions at connections for casings that are not available with threaded companion flanges.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw.
3. Pump Shaft: Steel, with oil lubricated copper-alloy shaft sleeve.

4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.

5. Pump Bearings:

a. Oil lubricated, bronze-journal.

D. Motor: Single speed and rigidly or resiliently mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials:

1) Cast iron.

c. Motor Bearings: Permanently lubricated ball bearings.
d. Efficiency:

1) Premium efficient.

e. Service Factor: 1.15

2.2 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. Flofab
4. Grundfos Pumps Corporation.
5. ITT Corporation; Bell & Gossett.
6. Mepco, LLC.
7. PACO Pumps; Grundfos CBG.
8. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
9. TACO Incorporated.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded or threaded companion-flange or union-end connections or unions at connections for casings that are not available with threaded companion flanges.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
3. Pump Shaft: Steel, with oil lubricated copper-alloy shaft sleeve.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings:
    1. Oil lubricated, bronze-journal.

D. Motor: Single speed and rigidly or resiliently mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

    a. Enclosure: Open, dripproof.
    b. Enclosure Materials:

        1) Cast iron.

    c. Motor Bearings:

        1) Grease-lubricated ball bearings.

d. Efficiency:

1) Premium efficient.

e. Service Factor: 1.15.

2.3 CLOSE-COUPLED, END-SUCTION CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. Flofab
4. ITT Corporation; Bell & Gossett.
5. ITT Corporation; Goulds Pumps.
6. PACO Pumps; Grundfos CBG.
7. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
8. Peerless Pump Company.
9. TACO Incorporated.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally. Rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

1. Casing: Radially split, cast iron, bronze fitted, with drain plug at bottom and air vent at top of volute, threaded gage tappings at inlet and outlet, and threaded flanged or companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. ~~For constant-speed pumps,~~ Trim impeller to match specified performance.
3. Pump Shaft:

   a. Steel, with oil lubricated copper-alloy shaft sleeve.

4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings:
   a. Oil lubricated, bronze-journal.

D. Motor: Single speed and rigidly mounted to pump casing with integral pump support.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron.
c. Motor Bearings: Grease-lubricated ball bearings.
d. Efficiency:

1) Premium efficient.

e. Service Factor: 1.15

2.4 SEPARATELY COUPLED, HORIZONTALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. Flofab
4. Grundfos Pumps Corporation.
5. ITT Corporation; Bell & Gossett.
6. PACO Pumps; Grundfos CBG.
7. Peerless Pump Company.
8. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
9. TACO Incorporated.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally. Rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

1. Casing: Radially split, cast iron, bronze fitted, with threaded gage tappings at inlet and outlet, and threaded or threaded companion-flange or union-end connections or unions at connections for casings that are not available with threaded companion flanges.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. For pumps that are not frequency-drive controlled, trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings:
   a. Oil lubricated, bronze-journal.

D. Shaft Coupling: Molded-rubber insert with interlocking spider or interlocking frame with interconnecting springs capable of absorbing vibration.

E. Motor: Single speed and resiliently or rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

   a. Enclosure: Open, dripproof.
   b. Enclosure Materials: Cast iron.
   c. Motor Bearings: Grease-lubricated ball bearings.
   d. Efficiency:

      1) Premium efficient.

   e. Service Factor: 1.15

2.5 SEPARATELY COUPLED, VERTICALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

   1. Armstrong Pumps Inc.
   2. Aurora Pump; Division of Pentair Pump Group.
   3. Flofab
   4. ITT Corporation; Bell & Gossett.
   5. PACO Pumps; Grundfos CBG.
   6. Peerless Pump Company.
   7. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
   8. TACO Incorporated.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, bronze fitted, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted vertically. Rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

   1. Casing: Radially split, cast iron, bronze fitted, with threaded gage tappings at inlet and outlet and threaded companion-flange or union-end connections.
   2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
   3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
   4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
   5. Pump Bearings:
      a. Oil lubricated, bronze-journal.

D. Shaft Coupling: Axially split spacer coupling.

E. Motor: Single speed and rigidly mounted to pump casing with lifting eyebolt and supporting lugs in motor enclosure.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

    a. Enclosure: Open, dripproof.
    b. Enclosure Materials: Cast iron.
    c. Motor Bearings: Grease-lubricated ball bearings.
    d. Efficiency: Premium efficient.
    e. Service Factor: 1.15

2.6 SEPARATELY COUPLED, BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. Flofab
4. ITT Corporation; Bell & Gossett.
5. PACO Pumps; Grundfos CBG.
6. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
7. Peerless Pump Company.
8. TACO Incorporated.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, bronze fitted, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal. Rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

1. Casing: Radially split, cast iron, bronze fitted, with threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and threaded companion-flange or flanged connections.

    a. Provide integral mount on volute to support the casing, and provide attached piping to allow removal and replacement of impeller without disconnecting piping or requiring the realignment of pump and motor shaft.

2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps without frequency-drive control, trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings.

D. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration.

1. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor.

E. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

F. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

G. Motor: Single speed, secured to mounting frame, with adjustable alignment.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron.
c. Motor Bearings: Grease-lubricated ball bearings.
d. Efficiency: Premium efficient.
e. Service Factor: 1.15

2.7 SEPARATELY COUPLED, BASE-MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. ITT Corporation; Bell & Gossett.
4. PACO Pumps; Grundfos CBG.
5. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
6. TACO Incorporated.

B. Description: Factory-assembled and -tested, centrifugal, impeller-between-bearings, separately coupled, bronze fitted, double-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal. Rated for 175-psig minimum working pressure and a continuous water temperature of 250 deg F.

C. Pump Construction:

1. Casing: Horizontally split to allow removal of the top half of the casing which allows complete removal of the rotating assembly without disturbing the system piping, class 30 cast iron (300 psi), bronze fitted, with threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 250 flanges.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. For pumps without frequency-drive control, trim impeller to match specified performance.
3. Pump Shaft: Stainless steel with stainless steel shaft sleeves.

4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings.
6. External Seal Flushing Lines: Pumps used on an open system shall be furnished with and external flushing line for each seal with Purocell #900 replaceable cartridge filters and a shut-off isolation valve. The filter shall have the ability to remove particles down to five microns in size.

D. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration:

1. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor.

E. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

F. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

G. Motor: Single speed, secured to mounting frame, with adjustable alignment.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron.
c. Motor Bearings: Grease-lubricated ball bearings.
d. Efficiency: Premium efficient.
e. Service Factor: 1.15

2.8 SEPARATELY COUPLED, VERTICALLY MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. Flofab
4. ITT Corporation; Bell & Gossett.
5. PACO Pumps; Grundfos CBG.
6. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
7. Peerless Pump Company.
8. TACO Incorporated.

B. Description: Factory-assembled and -tested, centrifugal, impeller-between-bearings, separately coupled, bronze fitted, double-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted vertically. Rated for 175-psig minimum working pressure and a continuous water temperature of 250 deg F.

C. Pump Construction:

1. Casing: Horizontally split to allow removal of the top half of the casing which allows complete removal of the rotating assembly without disturbing the system piping, class 30 cast iron (300 psi), bronze fitted, with threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 250 flanges.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. For pumps without frequency-drive control, trim impeller to match specified performance.
3. Pump Shaft: Stainless steel with stainless steel shaft sleeves.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings.
6. External Seal Flushing Lines: Pumps used on an open system shall be furnished with and external flushing line for each seal with Purocell #900 replaceable cartridge filters and a shut-off isolation valve. The filter shall have the ability to remove particles down to five microns in size.

D. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration.

E. Motor: Single speed and secured to casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron.

c. Motor Bearings: Grease-lubricated ball bearings.
d. Efficiency:

a) Premium efficient.

e. Service Factor: 1.15

2.9 SEPARATELY COUPLED, VERTICALLY MOUNTED, TURBINE CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

1. Armstrong
2. Flowserve Corporation.
3. ITT Corporation; Bell & Gossett.

4. PACO Pumps; Grundfos CBG.
5. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
6. Fairbanks Morse.

B. Description: Factory-assembled and -tested, centrifugal, impeller-between-bearings, end-suction pump as defined in HI 2.1-2.2 and HI 2.3; designed for installation with pump and motor shafts mounted vertically and projecting into a sump. Rated for 175-psig minimum working pressure and a continuous water temperature of 200 deg F.

1. Single-stage.

C. Pump Construction:

1. Pump Bowl: Cast iron, with suction bell. Water passages of intermediate bowls shall be coated with porcelain enamel:

a. With basket strainer.

2. Impeller: statically and dynamically balanced and keyed to shaft. For pumps wihout frequency-drive control, trim impeller to match specified performance.

a. ASTM B 584, cast bronze.

3. Pump Shaft: Stainless steel sized according to manufacturer's requirements.
4. Pump Bearings: Water-lubricated bronze and rubber sleeve bearings in cast-iron housing.

5. Pump Column: ASTM A 53, Grade B steel pipe.
6. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
7. Replaceable Seal: Seal shall be replaceable without removing the motor or disturbing the piping.

D. Shaft Coupling: Keyed with locking collets.

E. Discharge Head: ASME B16.1, discharge flange with threaded gage tapping. Top of discharge head shall have a registered fit to accurately locate the driver.

1. Class 125.

F. Drive Ratchet: Nonreversing ratchet.

G. Hollow Shaft Motor: Single speed and secured to discharge head.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron.

c. Motor Bearings: Grease-lubricated ball bearings.
d. Efficiency: Premium efficient.
e. Service Factor: 1.15

2.10 WET-ROTOR PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Flowserve Corporation.
3. Grundfos Pumps Corporation.

4. ITT Corporation; Bell & Gossett.
5. TACO Incorporated.

B. Description: Factory-assembled and -tested, horizontal inline, wet-rotor pump. Pump and motor assembled on a common shaft in hermetically sealed unit without stuffing box or mechanical seals. Include isolation of motor section from motor-stator windings by corrosion-resistant, nonmagnetic, alloy liner. Include design rated for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

1. Body: 100 percent lead-free bronze. Cast iron, with stainless-steel liner, static O-ring seal to separate motor section from motor stator, and flanged piping connections.
2. Impeller: Polypropylene Overhung, single suction, closed or open, nonmetallic.
3. Pump Shaft: Stainless Steel.
4. Bearings. Double-sintered carbon.

D. Motor: Single speed.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.11 AUTOMATIC CONDENSATE PUMP UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Beckett Corporation.
2. Hartell Pumps Div.; Milton Roy Co.
3. Little Giant Pump Co.
4. Mepco, LLC.

B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve and a 72-inch-minimum, electrical power cord with plug.

2.12 DOMESTIC WATER PUMPS

A. Casings and all wetted parts in pumps used in domestic water systems shall be stainless steel.

B. See Division 22 Section “Domestic Water Pumps”.

2.13 PUMP SPECIALTY FITTINGS

A. Suction Diffuser:

1. Angle pattern.
2. 175-psig pressure rating, cast-iron body and end cap, pump-inlet fitting.
3. Bronze startup and bronze or stainless-steel permanent strainers.
4. Bronze or stainless-steel straightening vanes.
5. Drain plug.
6. Factory-fabricated support.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Install pumps according to HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

B. Comply with HI 1.4.

C. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

D. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

E. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.

F. Equipment Mounting:

1. Install base-mounted pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Division 03 “Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

G. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and spring hangers elastomeric hangers of size required to support weight of in-line pumps.

1. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

3.3 ALIGNMENT

A. Engage a factory-authorized service representative to perform alignment service.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Division 23 Section "Steam and Condensate Heating Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to pump, allow space for service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install check, shutoff, and throttling on discharge side of pumps.

E. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

F. Install suction diffuser and shutoff valve on suction side of vertical-inline and base-mounted pumps.

G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

H. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

I. Install thermometers at pump suction and discharge.

J. Install check valve and gate or ball valve on each condensate pump unit discharge.

K. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

L. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

   a. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents.
   b. Verify bearing lubrication.

   c. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

   d. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Open cooling water-supply valves in cooling water supply to bearings, where applicable.
7. Open cooling water-supply valves if stuffing boxes are water cooled.
8. Open sealing liquid-supply valves if pumps are so fitted.
9. Open warm-up valves of pumps handling hot liquids if pumps are not normally kept at operating temperature.
10. Open circulating line valves if pumps should not be operated against dead shutoff.
11. Start motor.
12. Open discharge valve slowly.
13. Observe leakage from stuffing boxes and adjust sealing liquid valve for proper flow to ensure lubrication of packing. Let packing "run in" before reducing leakage through stuffing boxes; then tighten glands.
14. Check general mechanical operation of pumps and motors.
15. Close circulating line valves once there is sufficient flow through pumps to prevent overheating.

B. When pumps are to be started against closed check valves with discharge shutoff valves open, steps are the same, except open discharge valves before starting motors.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
3. Review data in maintenance manuals. Refer to Division 1 Section Contract Closeout.
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 232123

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 232513

WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following water treatment for closed-loop hydronic systems:

1. Manual chemical-feed equipment.
2. Automatic chemical-feed equipment.
3. Chemicals.

B. Related Requirements:

1. Section 232516 “Water Treatment for Open-Loop Hydronic Systems

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

B. RO: Reverse osmosis.

C. TSS: Total suspended solids are solid materials, including organic and inorganic, that are suspended in the water. These solids may include silt, plankton, and industrial wastes.

1.4 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for the following products:

1. Bypass feeders.
2. Water meters.
3. Chemical solution tanks.
4. Chemical material safety data sheets.

B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to hydronic systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Water Analysis Provider Qualifications: Verification of experience and capability of HVAC water-treatment service provider.

C. Field quality-control reports.

D. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in "Performance Requirements" Article.

2. Water Analysis: Illustrate water quality available at Project site.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sensors, injection pumps, and controllers to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

1.8 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion and scale formation for hydronic piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion and shall include the following:

1. Initial water analysis and HVAC water-treatment recommendations.

2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.

3. Customer report charts and log sheets.

4. Laboratory technical analysis.

5. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Nalco Water

2.2 PERFORMANCE REQUIREMENTS

A.

B. Water quality for hydronic systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of hydronic equipment without creating a hazard to operating personnel or the environment.

C. Base HVAC water treatment on quality of water available at Project site, hydronic system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

D. Closed hydronic systems, including:

1. Hot-water heating

2. Chilled water
3. Glycol heating

E. Closed hydronic systems, shall have the following water qualities:
1. pH: Maintain a value within the combined recommendations of the various equipment manufacturers.
2. Nitrite: Maintain a value within 800 to 1000 ppm.
3. Microbiological Limits:
a. Total Aerobic Plate Count: Maintain a maximum value of zero organisms/mL.

2.3 MANUAL CHEMICAL-FEED EQUIPMENT

A. Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch fill opening in the top, and NPS 3/4 bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.
1. Capacity:
a. 5 gal.
2. Minimum Working Pressure:
a. 125 psig

2.4 CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment and that can attain water quality specified in "Performance Requirements" Article.

2.5 GLYCOL FEED SYSTEM

A. One (1) 50-gallon polyethylene feed tank. Wall thickness shall be a minimum of ¼”. Tank shall be mounted on a steel frame with accommodations for mounting a pump underneath. Tank shall be supplied with a removable lid and all interconnecting piping to pump including strainer and isolation valve. Tank height including stand shall not exceed 48". Tank stand shall be finished with an epoxy powder coating to protect against corrosion.

B. One (1) Level switch to deactivate pump and activate alarm on low glycol level in the feed tank.

C. One (1) Control panel shall house switching device for pump, audible alarm, HOA switch for pump, lights to indicate power and low level, pushbutton for alarm silence. Enclosure shall be NEMA 12. Control panel shall be mounted on the tank stand.

D. One (1) 1/3 HP centrifugal pump mounted under the feed tank. Materials of construction shall be bronze. Pump shall provide 2.5 GPM at 60 PSIG. Rotary gear pump is not acceptable.

E. Pressure switch shall be Honeywell L404F1078 or Square D 9012 GNG-4. One (1) Pressure switch set at:
1. Field determine PSIG to activate the glycol feed pump.
2. Field determine PSI for differential setting for the pressure switch.

F. GLYCOL
1. The glycol provided shall be propylene glycol as manufactured by Dow Chemical, Huntsman Chemical, or Interstate Chemical. Trade name shall be DowFrost HD, JeffCool HD, or Intercool NFP. The water quality in the hot/chilled water system shall meet the recommendations of the glycol manufacturer so as to reduce the formation of sludge. If the water quality at the jobsite does not meet manufacturers recommendations then the

glycol solution shall be provided pre-mixed with deionized water. An analysis of the glycol solution and the water quality shall be included in the O&M manuals. Glycol percentage shall be:

a. 30 % by volume.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.

B. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Install water testing equipment on wall near water chemical application equipment.

D. Install glycol feed system per manufacturers recommendations.

E. Install interconnecting control wiring for chemical treatment controls and sensors.

F. Mount sensors and injectors in piping circuits.

G. Bypass Feeders: Install in closed hydronic systems, including:

1. Hot-water heating
2. Chilled water

H. Bypass Feeders: Install in closed hydronic systems, and equipped with the following:

1. Install bypass feeder in a bypass circuit around circulating pumps unless otherwise indicated on Drawings.
2. Install water meter in makeup-water supply.
3. Install test-coupon assembly in bypass circuit around circulating pumps unless otherwise indicated on Drawings.
4. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below the feeder inlet.
5. Install a swing check on the inlet after the isolation valve.

3.3 CONNECTIONS

A. Where installing piping adjacent to equipment, allow space for service and maintenance.

B. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Comply with requirements in Section 232116 "Hydronic Piping Specialties."

C. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Section 230523 "General-Duty Valves for HVAC Piping."

D. Comply with requirements in Section 221119 "Domestic Water Piping Specialties" for backflow preventers required in makeup-water connections to potable-water systems.

E. Confirm applicable electrical requirements in electrical Sections for connecting electrical equipment.

F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of hydronic systems' startup procedures.
4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
8. Repair leaks and defects with new materials and retest piping until no leaks exist.

C. Equipment will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. At quarterly intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to "Performance Requirements" Article.

F. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Acidity and Alkalinity: ASTM D 1067.
3. Iron: ASTM D 1068.
4. Water Hardness: ASTM D 1126.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

B. Training: Provide a "how-to-use" self-contained breathing apparatus video that details exact operating procedures of equipment.

END OF SECTION 232513

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 233001

COMMON DUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. General procedures and requirements for ductwork.

2. Repair leaks in ductwork, as identified by smoke test, at no additional cost to Owner.

3. Soundproofing procedures for duct penetrations of walls, ceilings, and floors in mechanical equipment rooms.

B. Related Sections:

1. Division 07: Quality of Acoustic Sealant.

2. Section 230500: Common Work Results for HVAC

3. Section 230593: Testing Adjusting and Balancing for HVAC.

1.2 SUBMITTALS

A. Samples: Sealer and gauze proposed for sealing ductwork.

B. Quality Assurance / Control:

1. Manufacturer's installation manuals providing detailed instructions on assembly, joint sealing, and system pressure testing for leaks.

2. Specification data on sealer and gauze proposed for sealing ductwork.

1.3 QUALITY ASSURANCE

A. Requirements: Construction details not specifically called out in Contract Documents shall conform to applicable requirements of SMACNA HVAC Duct Construction Standards.

B. Pre-Installation Conference: Schedule conference immediately before installation of ductwork.

PART 2 - PRODUCTS

2.1 Finishes, Where Applicable: Colors as selected by Architect.

2.2 Duct Hangers:

A. One inch by 18 ga galvanized steel straps or steel rods as shown on Drawings, and spaced not more than 96 inches apart. Do not use wire hangers.

1. Attaching screws at trusses shall be 2 inch No. 10 round head wood screws. Nails not allowed.

2. Attach threaded rod to steel joist with Grinnell Steel washer plate Fig. 60 - ph-1. Double nut connection.

2.3 Penetration Soundproofing Materials:

A. Insulation for Packing: Fiberglass.

B. Calking: Polysulphide.

C. Escutcheon Frame: 22 ga galvanized iron 2 inches wide.

PART 3 - EXECUTION

3.1 INSTALLATION

A. During installation, protect open ends of ducts by covering with plastic sheet tied in place to prevent entrance of debris and dirt.

B. Make necessary allowances and provisions in installation of sheet metal ducts for structural conditions of building. Revisions in layout and configuration may be allowed, with prior written approval of Architect. Maintain required airflows in suggesting revisions.

C. Hangers And Supports:

1. Install upper ends of hanger securely to floor or roof construction above by method shown on Drawings.

2. Attach strap hangers to ducts with cadmium-plated screws. Use of pop rivets or other means will not be accepted.

3. Where hangers are secured to forms before concrete slabs are poured, cut off flush all nails, strap ends, and other projections after forms are removed.

4. Secure vertical ducts passing through floors by extending bracing angles to rest firmly on floors without loose blocking or shimming. Support vertical ducts, which do not pass through floors, by using bands bolted to walls, columns, etc. Size, spacing, and method of attachment to vertical ducts shall be same as specified for hanger bands on horizontal ducts.

D. Penetration Soundproofing

1. Pack space between ducts and structure full of fiberglass insulation of sufficient thickness

to be wedged tight, allowing space for application of calking.

2. Provide calking at least 2 inches thick between duct and structure on both ends of opening through structure.

3. Provide metal escutcheon on Equipment Room side. Secure escutcheon to wall.

3.2 CLEANING

A. Clean interior of duct systems before final completion.

END OF SECTION 233001

SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round and flat-oval ducts and fittings.
4. Double-wall round and flat-oval ducts and fittings.
5. Exhaust Air Stacks
6. Guy wires and connectors.
7. Sheet metal materials.
8. Duct liner.
9. Sealants and gaskets.
10. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
3. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
4. Section 230713 “Duct Insulation” for duct insulation and fire wrap.

C. Stacks from the exhaust systems are to be designed per SMACNA guidelines. Use the “Guide for steel stack design and Construction” the latest edition. The outside of the stacks are to be painted with Pota-Pox. 80 series 141 material. Color is to be selected by the architect. Provide guy wires and angle supports. Construction shall be a minimum of 10 gauge and shall be painted on the inside of the stack and on the exterior where the stack is exterior to the building.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Seismic Performance: Duct hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."

1. For equipment with a seismic importance factor of 1.0 the term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
2. For equipment with a seismic importance factor of 1.5 the term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

C. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

D. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
3. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
4. Duct-Cleaning Test Report for Prerequisite IEQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."
5. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
6. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.

7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
13. Duct fabrication shall not begin until shop drawings have been submitted and reviewed by the mechanical engineer.

D. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including, but not limited to the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.

3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Duct dimensions shown on drawings are inside clear dimensions.

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

B. Duct dimensions shown on drawings are inside clear dimensions.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and

Flexible."

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg Fat 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

G. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

H. Inner Duct: Minimum 0.028-inchsolid sheet steel.

I. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Traverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

J. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Duct dimensions shown on drawings are inside clear dimensions.

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals,

and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

E. Longitudinal Seams: Not allowed.

F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

B. Duct dimensions shown on drawings are inside clear dimensions.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

   a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

2. Longitudinal Seams: Not allowed.
3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: Minimum 0.028-inch solid sheet steel.

1. Perforated inner ducts exposed to air movement shall not be used in supply air ducts upstream of the following rooms: Operating rooms, trauma rooms, LDR rooms, NICU nurseries, ICU nurseries, positive pressure isolation rooms, cath labs, bone marrow, triage rooms, angiogram rooms, fluoroscopy rooms, linear accelerators, decontamination areas and any invasive procedure rooms where the duct insulation could be a source of contamination.
2. Inner duct shall be solid sheet steel a minimum of 10 feet downstream of humidifiers and/or air washers.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg Fat 75 deg F mean temperature.

2.5 EXHAUST AIR STACKS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Not allowed.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Design Wind Loads: 150 mph.

F. Design for seismic conditions at Project site.

G. Accessories: Terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as duct straight sections.

1. Termination: Antibackdraft damper.

H. Drain: Provide drain section incorporated into base of stack with trap. Seal depth design to prevent seal blowout at highest estimated static pressure.

I. Guying and Bracing Materials

1. Cable: Three minimum galvanized or stainless steel, stranded wires of the following thickness: [Four] <Insert number> [stainless steel]

a. Minimum Size: 1/4 inch in diameter.
b. For ID Sizes 4 to 15 Inches: 5/16 inch.
c. For ID Sizes 18 to 24 Inches: 3/8 inch.
d. For ID Sizes 27 to 30 Inches: 7/16 inch.
e. For ID Sizes 33 to 36 Inches: 1/2 inch.
f. For ID Sizes 39 to 48 Inches: 9/16 inch.
g. For ID Sizes 51 to 60 Inches: 5/8 inch.

2. Cable Hardware: Provide duct angle ring, turnbuckles, cable loop thimbles, cable clamps and all hardware necessary to brace stack.
3. Pipe: Two galvanized steel, NPS 1-1/4. [Three].
4. Angle Iron: Two galvanized steel, 2 by 2 by 0.25 inch. [Three].

2.6 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008, with oiled, matte finish for exposed ducts.

D. Reinforcement Shapes and Plates: ASTM A 36, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.7 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.

2. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive:

a. Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
b. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
c. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA Inc.
b. Armacell LLC.
c. Rubatex International, LLC

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, , length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. 0.135-inch-diameter shank.

2. Insulation-Retaining Washers: With beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Self-locking washers formed from 0.016-inch-thick aluminum.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards -

Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inchestransversely; at 3 inchesfrom transverse joints and at intervals not exceeding 18 incheslongitudinally.
7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.

8. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated build-outs (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless

steel, or aluminum.

10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.9 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 2 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines".

M. Where ducts pass through sound-rated walls, fill the opening between the partition and duct with insulation and seal the opening.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and

sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct. [20 feet]

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

D. Perform a light test of grease ductwork per 2012 International Mechanical Code paragraph 506.3.2.5. prior to concealment by insulation or covered by shaft.

1. Perform light test in the presence of local Inspector/Engineer.
2. Document whether test passed or failed.
3. Repair any joints or duct welds that fail light test to the point the ductwork passes the light test.

E. Install grease duct with minimum clearance to combustibles as required by IBC and local codes. Installations that do not meet the minimum required clearances shall be fire wrapped as specified in Section 230713 “Duct Insulation”.

F. Provide approved fire-wrap insulation that meets ASTM C 656.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class A.
4. Outdoor, Return-Air Ducts: Seal Class A.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class A.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class A.
8. Unconditioned Space, Return-Air Ducts: Seal Class A.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class A.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
11. Conditioned Space, Exhaust Ducts: Seal Class A.
12. Conditioned Space, Return-Air Ducts: Seal Class A.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inchesthick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inchesthick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."

1. Comply with ASCE/SEI 7.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

   a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
   b. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
   c. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
   d. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
   e. Outdoor Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

   a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

3. Any liner showing evidence that is has wet at any time shall be removed and replaced with new liner.

   a. Disinfect affected sheet metal, and pins.
   b. Install new liner per specifications

   c. Seal friable edges and seams of repaired liner.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 DUCT CLEANING

A. Clean new duct system before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under

negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Provide drainage and cleanup for wash-down procedures.

7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.11 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.12 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel.

B. Ductwork running in areas where there are no ceilings or when noted on the drawings shall be doubled wall duct and shall meet the requirements indicated below.

C. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

   a. Pressure Class: Positive 2-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 16.
   d. SMACNA Leakage Class for Round and Flat Oval: 8.

2. Ducts Connected to Constant-Volume Air-Handling Units:

   a. Pressure Class: Positive 3-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 8.
   d. SMACNA Leakage Class for Round and Flat Oval: 4.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

   a. Pressure Class: Positive 6-inch wg.

b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 4.
d. SMACNA Leakage Class for Round and Flat Oval: 2.

4. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 4-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 4.
d. SMACNA Leakage Class for Round and Flat Oval: 2.

D. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 16.
d. SMACNA Leakage Class for Round and Flat Oval: 8 .

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 16.
d. SMACNA Leakage Class for Round and Flat Oval: 8.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

E. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 16.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

a. Pressure Class: Positive 6-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 4.
d. SMACNA Leakage Class for Round and Flat Oval: 2.

4. Ducts Connected to Type I (Grease) Commercial Kitchen Hoods: Comply with NFPA 96.

   a. Exposed to View: 18 gauge Type 304, stainless-steel sheet, No. 4 finish.
   b. Concealed: 16 gauge black steel.
   c. Pressure Class: Positive or negative 3-inch wg.
   d. Welded seams and joints.
   e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   f. SMACNA Leakage Class: 2.
   g. A light test shall be performed for grease duct prior to concealing the duct.

5. Ducts Connected to Type II (Heat) Commercial Kitchen Hoods:

   a. Type 304, stainless-steel sheet.
   b. Exposed to View: No. 4 finish.
   c. Pressure Class: Positive or negative 3-inch wg.
   d. Concealed: No. 2D finish.
   e. Welded seams and joints.
   f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   g. SMACNA Leakage Class: 2.

6. Ducts Connected to Dishwasher and Low Temperature Vapor and Odor Hoods:

   a. Type 304, stainless-steel sheet.
   b. Exposed to View: No. 4 finish. Pressure Class: Positive or negative 3-inch wg.
   c. Concealed: No. 2D finish.
   d. Welded seams and flanged joints with watertight EPDM gaskets.
   e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations, flanged joints class A.
   f. SMACNA Leakage Class: 2.

7. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:

   a. Type 304, stainless-steel sheet.

      1) 0.05-inch thick.
      2) Exposed to View: No. 4 finish.
      3) Concealed: No. 2B finish.
   b. Pressure Class: Positive or negative 6-inch wg.
   c. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   d. SMACNA Leakage Class: 2.
   e. Main laboratory exhaust trunks to be galvanized steel with same pressure, seal and leakage class.

8. Ducts Connected to Cage Wash Areas:

a. Type 316 .05-inch thick stainless-steel sheet.

1) Exposed to View: No. 4 finish.
2) Concealed: No. 2B finish.

b. Pressure Class: Positive or negative 6-inch wg.
c. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
d. SMACNA Leakage Class: 2.

9. Ducts Connected to radioactive fume hoods:

a. Type 316 .05-inch thick stainless-steel sheet.

1) Exposed to View: No. 4 finish.
2) Concealed: No. 2B finish.

b. Pressure Class: Positive or negative 6-inch wg.
c. Minimum SMACNA Seal Class: A. Flanged and gasketed joints for future disassembly for decontamination.
d. SMACNA Leakage Class: 2.

10. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 4-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 4.
d. SMACNA Leakage Class for Round and Flat Oval: 2

F. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 16.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round and Flat Oval: 4.

G. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. Stainless-Steel Ducts:

   a. Exposed to Airstream: Match duct material.
   b. Not Exposed to Airstream: Match duct material.

3. Aluminum Ducts: Aluminum.

H. Duct Liner Restrictions:

1. Duct liner exposed to air movement shall not be used in supply air ducts serving the following rooms: Operating rooms, trauma rooms, LDR rooms, NICU nurseries, ICU nurseries, positive pressure isolation rooms, cath labs, bone marrow, triage rooms, angiogram rooms, fluoroscopy rooms, linear accelerators, decontamination areas and any invasive procedure rooms where the duct insulation could be a source of contamination.
2. Duct Liner exposed to air movement shall not be used on medium pressure ductwork (2000 to 4000 FPM velocity). See section 230713 “Duct Insulation” for insulation requirements.
3. Duct Liner exposed to air movement shall not be used on high pressure ductwork (Greater than 4000 FPM velocity). See section 230713 “Duct Insulation” for insulation requirements.
4. All duct liner shall meet all of the requirements found in 2012 IECC

I. Liner:
1. Low Pressure Supply Air Ducts (Less than 2000 FPM velocity): Fibrous glass, Type I, 1 inch thick.
2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
4. Supply Fan Plenums: Fibrous glass, Type I, 1 inch thick.
5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 1 inch thick.
6. Transfer Ducts: Fibrous glass, Type I or flexible elastomeric, 1 inch thick.

J. Double-Wall Duct Interstitial Insulation:

1. Supply Air Ducts: 1 inch thick.
2. Return Air Ducts: 1 inch thick.
3. Exhaust Air Ducts: 1 inch thick.

K. Exterior Ductwork Liner Insulation:

1. Supply Air Ducts: 2 inch thick with a minimum R value of 8.0.
2. Return Air Ducts: 2 inch thick with a minimum R value of 8.0.
3. Exhaust Air Ducts: 2 inch thick with a minimum R value of 8.0.

L. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction

Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

      1) Velocity 1000 fpm or Lower: 1.0 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm: 1.5 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      4) Radius-to Diameter Ratio: 1.5.

   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

M. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

   a. Rectangular Main to Rectangular Branch: 45-degree entry high efficiency take-off.
   b. Rectangular Main to Round Branch: 45-degree entry high efficiency take-off.

2. Round and Flat Oval:
   a. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
   b. Velocity 1000 to 1500 fpm: 45-degree entry high efficiency tap.
   c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 233119

HVAC CASINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Factory-fabricated, field-assembled, single- and double-wall casings for HVAC equipment.

1.3 PERFORMANCE REQUIREMENTS

A. Static-Pressure Classes:

1. Upstream from Fan(s): 2-inch wg.

2. Downstream from Fan(s): 4-inch wg.

B. Structural Performance:

1. Casings shall be fabricated to withstand 133 percent of the indicated static pressure without structural failure. Wall and roof deflection at the indicated static pressure shall not exceed 1/8 inch per foot of width.

a. Fabricate outdoor casings to withstand wind load of 15 lbf/sq. ft. and snow load of 30 lbf/sq. ft..

C. Seismic Performance: HVAC casings shall withstand the effects of earthquake motions determined according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Factory-fabricated casings.

2. Liners and adhesives.

3. Sealants and gaskets.

4. Seismic-restraint devices.

B. Shop Drawings: For HVAC casings. Include plans, elevations, sections, components, and attachments to other work.

1. Detail HVAC casing assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Sheet metal thickness(es).

3. Reinforcement and spacing.

4. Seam and joint construction.

5. Access doors including frames, hinges, and latches.

6. Filter, coil, humidifier, and other apparatus being installed in and mounted on casing.

7. Locations for access to internal components.

8. Hangers and supports including methods for building attachment, vibration isolation, seismic restraints, and casing attachment.

9. Interior lighting, including switches.

C. Welding certificates.

D. Product Certificates: For acoustically critical casings, from manufacturer.

1. Show sound-absorption coefficients in each octave band lower than those scheduled when tested according to ASTM C 423.

2. Show airborne sound transmission losses lower than those scheduled when tested according to ASTM E 90.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for casing joint and seam welding.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate sizes and locations of steel supports. Supports are specified in Division 05 Section "Metal Fabrications."

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 GENERAL CASING FABRICATION REQUIREMENTS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 6, "Equipment and Casings," for acceptable materials, material thicknesses, and casing construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

1. Fabricate casings with more than 3-inch wg negative static pressure according to SMACNA's "Rectangular Industrial Duct Construction Standards."

2. Casings with more than 2-inch wg positive static pressure may be fabricated according to SMACNA's "Rectangular Industrial Duct Construction Standards."

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Exterior Surface Galvanized Coating Designation: G90.

2. Interior Surface Galvanized Coating Designation:

a. Sections Not Exposed to Moisture: G90.

b. Sections Housing and Downstream from Cooling Coil and Humidifiers: G90.

C. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the interior sheet metal surfaces of casing in contact with the airstream. Apply untreated clear coating to the exterior surface.

2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

3. Coating containing the antimicrobial compound shall have a hardness of 2H minimum when tested according to ASTM D 3363.

4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 according to UL 723; certified by an NRTL.

5. Applied Coating Color: Standard.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Sealing Requirement: SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class A. Seal all seams, joints, connections, and abutments to building.

F. Penetrations: Seal all penetrations airtight. Cover with escutcheons and gaskets, or fill with suitable compound so there is no exposed insulation. Provide shaft seals where fan shafts penetrate casing.

G. Access Doors: Fabricate access doors according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 6-11, "Casing Access Doors - 2-inch wg," and Figure 6.12, "Casing Access Doors - 3-10-inch wg"; and according to pressure class of the plenum or casing section in which access doors are to be installed.

1. Size: 20 by 54 inches.

2. Vision Panel: Double-glazed, wire-reinforced safety glass with an airspace between panes and sealed with interior and exterior rubber seals.

3. Hinges: Piano or butt hinges and latches, number and size according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

4. Latches: Minimum of two wedge-lever-type latches, operable from inside and outside.

5. Neoprene gaskets around entire perimeters of door frames.

6. Doors shall open against air pressure.

H. Condensate Drain Pans: Formed sections of Type 304, stainless-steel sheet complying with requirements in ASHRAE 62.1. Pans shall extend a minimum of 12 inches past coil.

1. Double-wall construction shall have space between walls filled with foam insulation and sealed moisture tight.

2. Intermediate drain pan or drain trough shall collect condensate from top coil for units with stacked coils or stacked eliminators.

3. Insulation: Polystyrene or polyurethane.

4. Slopes shall be in a minimum of two planes to collect condensate from cooling coils (including coil piping connections and return bends), eliminators, and humidifiers when units are operating at maximum catalogued face velocity across cooling coil.

5. Each drain pan connection shall have a trap. Drain traps with depth and height differential between inlet and outlet equal or greater to the design static pressure plus 2-inch wg. Include slab height in trap calculation.

2.2 SHOP-FABRICATED CASINGS

A. Double-Wall Casing Inner Panel: Solid sheet steel. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for sheet metal thickness based on indicated static-pressure class unless otherwise indicated.

B. Interstitial Insulation: Polyurethane foam complying with NFPA 90A or NFPA 90B.

C. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Coat insulation with antimicrobial coating.

3. Cover insulation with polyester film complying with UL 181, Class 1.

D. Interstitial Insulation: Flexible-elastomeric duct liner complying with ASTM C 534, Type II for sheet materials and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

E. Fabricate casings with standing seams and angle-iron reinforcements unless otherwise indicated.

F. Fabricate close-off sheets from casing to dampers, filter frames, and coils and between stacked coils. Use galvanized sheet steel of same thickness as casing and with a galvanized coating designation of G90.

G. Bolt close-off sheets to frame flanges and housings. Support coils on stands fabricated from galvanized-steel angles or channels.

H. Reinforce casings with galvanized-steel angles.

2.3 MANUFACTURED CASINGS

A. Description: Double-wall, insulated, pressurized equipment casing.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acoustical Surfaces, Inc.

2. AeroSonics, Inc.; a division of TUTCO, Inc.

3. Buffalo Air Handling.

4. CertainTeed Corp.; Insulation Group.

5. CLEANPAK International.

6. D&D Sound Control.

7. IACL.

8. Industrial Noise Control, Inc.

9. McGill AirSilence LLC.

10. Ruskin.

11. SEMCO Incorporated.

12. Vibro-Acoustics.

C. Double-Wall Panel Fabrication: Solid, galvanized sheet steel exterior wall and solid perforated, galvanized sheet steel interior wall; with space between wall filled with insulation.

1. Wall Thickness: 4 inches.

2. Fabricate with a minimum number of joints.

3. Weld exterior and interior walls to perimeter; to interior, longitudinal, galvanized-steel channels; and to box-end internal closures. Paint welds.

4. Sheet metal thickness shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for static-pressure class indicated for casing.

5. Sheet Metal Thicknesses:

a. Exterior Wall Thickness: 0.040 inch minimum.

b. Interior Wall Thickness: 0.034 inch minimum.

6. Double-Wall Casing Inner Panel: Solid sheet steel.

7. Fill each panel assembly with insulating material that is noncombustible, inert, mildew resistant and vermin proof and that complies with NFPA 90A.

8. Fabricate panels with continuous tongue-and-groove or self-locking joints effective inside and outside each panel.

D. Trim Items: Fabricate from a minimum of 0.052-inch galvanized sheet steel, furnished in standard lengths for field cutting.

2.4 CASING LINER

A. Fibrous-Glass Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corp.; Insulation Group.

b. Johns Manville.

c. Knauf Insulation.

d. Owens Corning.

2. Antimicrobial Erosion-Resistant Coating: Apply to surface of the liner that will form the interior surface of casing to act as a moisture repellent and an erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

B. Natural-Fiber Casing Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor, and complying with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bonded Logic, Inc.

b. Reflectix Inc.

2. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested according to ASTM C 518.

3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized steel, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

D. Shop or Factory Application of Casing Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of casing liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of casing liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of casings or cut and fit to ensure butted-edge overlapping.

5. Apply adhesive coating on longitudinal seams in casings with air velocity of 2500 fpm.

6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from casing wall. Fabricate edge facings at the following locations:

   a. Fan discharges.

   b. Intervals of lined casing preceding unlined duct.

   c. Upstream edges of transverse joints in casings where air velocities are higher than 2500 fpm or where indicated.

8. Secure insulation between perforated sheet metal inner wall of same thickness as specified for outer wall. Use mechanical fasteners that maintain inner wall at uniform distance from outer wall without compressing insulation.

2.5 SEALANT MATERIALS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

   1. Application Method: Brush on.

   2. Solids Content: Minimum 65 percent.

   3. Shore A Hardness: Minimum 20.

   4. Water resistant.

   5. Mold and mildew resistant.

   6. VOC: Maximum 75 g/L (less water).

   7. Maximum Static-Pressure Class: 10-inch wg, positive or negative.

   8. Service: Indoor or outdoor.

   9. Substrate: Compatible with galvanized sheet steel or stainless steel.

C. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. VOC: Maximum 395 g/L.
9. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
10. Service: Indoor or outdoor.
11. Substrate: Compatible with galvanized sheet steel or stainless steel.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single component, acid curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine concrete bases roof curbs and steel supports for compliance with requirements for conditions affecting installation and performance of HVAC casings.

B. Examine casing insulation materials and liners before installation. Reject casings that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install casings according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Equipment Mounting: Install HVAC casings on concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

2. For supported casings, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Install seismic restraints on casings. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Apply sealant to joints, connections, and mountings.

E. Field-cut openings for pipe and conduit penetrations; insulate and seal according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Support casings on floor or foundation system. Secure and seal to base.

G. Support components rigidly with ties, braces, brackets, seismic restraints, and anchors of types that will maintain housing shape and prevent buckling.

H. Align casings accurately at connections, with 1/8-inch misalignment tolerance and with smooth interior surfaces.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual."

2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

3. Determine leakage from entire system or section of system by relating leakage to surface area of test section. Comply with requirements for leakage classification of ducts connected to casings.

B. HVAC casings will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 233119

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft dampers.
2. Pressure relief dampers.
3. Barometric relief dampers.
4. Manual volume dampers.
5. Control dampers.
6. Fire dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Duct silencers.
10. Turning vanes.
11. Remote damper operators.
12. Duct-mounted access doors.
13. Flexible connectors.
14. Flexible ducts.
15. Duct security bars.
16. Duct accessory hardware.
17. High efficiency take-offs.

B. Related Requirements:

1. Division 23 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 23 “Diffusers, Registers and Grilles”.
3. Division 28 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.
4. Division 28 "Zoned (DC-Loop) Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

2. Product Data for Prerequisite EA 2: Documentation indicating that duct insulation R-values comply with tables in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."

C. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.

b. Manual volume damper installations.

c. Control-damper installations.

d. Fire-damper, smoke-damper, combination fire- and smoke-damper, pressure relief-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.

e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653.

1. Galvanized Coating Designation: G60.

2. Exposed-Surface Finish: Mill phosphatized.

B. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

C. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Pottorff.
5. Ruskin Company.
6. United Enertech

B. Function:

1. Designed to allow airflow in one direction and prevent reverse airflow.
2. Keeps outside air out of the space by sensing and closing against mass flow.

C. Description:

1. Gravity balanced.

D. Maximum Air Velocity:

1. 1000 fpm

E. Maximum System Pressure:

1. 3-inch wg.

F. Frame: Hat-shaped, with welded corners or mechanically attached and mounting flange:

1. 16GA 0.063-inch- thick extruded aluminum.

G. Blades: Multiple single-piece blades, maximum 6-inch width noncombustible, tear-resistant, neoprene-coated fiberglass with sealed edges:

1. Center pivoted: 16GA 0.050-inch- thick aluminum sheet.

H. Blade Action: Parallel.

I. Blade Seals: Mechanically locked.

1. Neoprene.

J. Blade Axles: 0.20 inch diameter:

1. Material: Nonferrous metal.

K. Tie Bars and Brackets:

1. Aluminum.

L. Return Spring: Adjustable tension.

M. Bearings:

1. Synthetic pivot bushings.

N. Accessories.

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Screen Mounting: Front mounted in sleeve.
   a. Sleeve Thickness: 20 gage minimum.

b. Sleeve Length: 6 inches minimum.

4. Screen Mounting: Rear mounted.

5. Screen Material:

a. Aluminum.

6. Screen Type:

a. Bird

7. 90-degree stops.

2.4 PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.

2. Greenheck Fan Corporation.

3. Nailor Industries Inc.

4. Pottorff.

5. Ruskin Company.

B. Function:

1. Provide component designed to protect HVAC systems by relieving air pressure from within a space that is beyond a pre-determined limit.

2. To automatically begin to open at a pre-set pressure difference above maximum system pressure.

3. Internally self-controlled with system pressure utilizing adjustable arms and weights.

4. Self-actuated with system pressure utilizing adjustable arms and weights.

5. Employs blade counterbalancing.

6. Automatically closes and re-sets when pressures return to normal conditions.

C. Air Velocity:

1. 3900 fpm.

D. Maximum System Pressure (MSP):

1. 5-inch wg.

E. Differential Pressure Preset above MSP:

1. 1-inch wg.

F. Maximum Damper Pressure Limit:

1. 5.0-inch wg.

G. Frame Material: Flanged Channel:

1. 14GA 0.079-inch- thick galvanized steel.

H. Frame Depth: 8-inch- minimum.

I. Blades:

1. Material:

a. 16GA 0.063-inch- formed galvanized steel.

2. Type:

a. Formed Sheetmetal.

3. Blade-stop:
   a. With stop.

J. Blade Action: Parallel.

K. Blade Seals:
   1. Thermo Plastic Elastomer.

L. Blade Axles:
   1. Material:
      a. Plated steel.
   2. Diameter: 0.375 inch.

M. Linkage:
   1. External heavy duty type with galvanized steel clevis arms and plated steel tie bars & pivot pins with nylon pivot bearings.

N. Bearings:
   1. Galvanized Steel ball.

2.5 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a division of Mestek, Inc.
   2. Greenheck Fan Corporation.
   3. Nailor Industries Inc.
   4. Pottorff.
   5. Ruskin Company.

B. Function:
   1. Senses and compares outdoor ambient and indoor pressures.
   2. Allows any higher pressure indoor air to escape.

C. Description: Suitable for horizontal or vertical mounting.

D. Maximum Air Velocity:
   1. 1000 fpm

E. Maximum System Pressure:
   1. 3-inch wg.

F. Frame: Hat-shaped, with welded corners or mechanically attached and mounting flange.
   1. 13GA 0.094-inch- thick, galvanized sheet steel.

G. Blades: Multiple:
   1. 16GA 0.050-inch- thick aluminum sheet.
   2. Maximum Width: 6 inches.
   3. Action: Parallel.
   4. Balance: Gravity.
   5. Pivot:
      a. Eccentric.

H. Blade Seals:

1. Neoprene

I. Blade Axles:

1. Galvanized steel.

J. Tie Bars and Brackets: Rattle free with 90-degree stop.

1. Material:

a. Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings:

1. Synthetic

2.6 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Warming and Ventilating; a division of Mestek, Inc.

b. McGill AirFlow LLC.

c. Nailor Industries Inc.

d. Pottorff.

e. Ruskin Company.

f. United Enertech

2. Standard leakage rating , with linkage outside airstream .

3. Suitable for horizontal or vertical applications.

4. Frames: Hat-shaped, Mitered and welded corners. Flanges for attaching to walls and flangeless frames for installing in ducts.

a. 16GA 0.064-inch thick, galvanized sheet steel.

5. Blades:

a. Multiple or single blade. Parallel- or opposed-blade design. Stiffened damper blades for stability.

b. Material:

1) Galvanized -steel, 16GA 0.064 inch thick.

6. Blade Axles:

a. Nonferrous metal

b. Shall extend full length of damper blades in ducts with pressure classes of 3-inch wg or more.

7. Bearings:

a. Material:

1) Molded synthetic.

b. Bearings at both ends of damper operating shafts in ducts with pressure classes of 3-inch wg or more.

8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Warming and Ventilating; a division of Mestek, Inc.
      b. McGill AirFlow LLC.
      c. Nailor Industries Inc.
      d. Pottorff.
      e. Ruskin Company.
      f. United Enertech
   2. Standard leakage rating, with linkage outside airstream.
   3. Suitable for horizontal or vertical applications.
   4. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
   5. Blades:
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
      e. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
   6. Blade Axles: Nonferrous metal.
   7. Bearings:
      a. Molded synthetic.
      b. Dampers in ducts with pressure classes of 3-inch wg or more shall have axles full length of damper blades and bearings at both ends of operating shaft.
   8. Tie Bars and Brackets: Aluminum.

C. Low-Leakage, Steel, Manual Volume Dampers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Warming and Ventilating; a division of Mestek, Inc.
      b. McGill AirFlow LLC.
      c. Nailor Industries Inc.
      d. Pottorff.
      e. Ruskin Company.
      f. United Enertech
   2. Comply with AMCA 500-D testing for damper rating.
   3. Low-leakage rating , with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
   4. Suitable for horizontal or vertical applications.
   5. Frames:
      a. Frame: Hat-shaped,

1) 16GA 0.064-inch thick, galvanized sheet steel.

b. Mitered and welded corners.

c. Flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

a. Multiple or single blade.

b. Parallel- or opposed-blade design.

c. Stiffen damper blades for stability.

d. Material:

1) Galvanized, roll-formed steel, 16GA 0.064 inch thick.

7. Blade Axles:

a. Nonferrous metal.

8. Bearings:

a. Molded synthetic.

b. Dampers in ducts with pressure classes of 3-inch wg or more shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals:

a. Neoprene.

10. Jamb Seals: Cambered Stainless steel or aluminum.

11. Tie Bars and Brackets: Galvanized steel or aluminum.

12. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

D. Low-Leakage, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Warming and Ventilating; a division of Mestek, Inc.

b. Nailor Industries Inc.

c. McGill AirFlow LLC.

d. Pottorff.

e. Ruskin Company.

f. United Enertech

2. Comply with AMCA 500-D testing for damper rating.

3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

4. Suitable for horizontal or vertical applications.

5. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

a. Multiple or single blade.

b. Parallel- or opposed-blade design.

c. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.

d. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.

7. Blade Axles: Nonferrous metal.

8. Bearings:

a. Molded synthetic.

b. Dampers in ducts with pressure classes of 3-inch wg or more shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Neoprene.

10. Jamb Seals: Cambered aluminum.

11. Tie Bars and Brackets: Aluminum.

12. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

E. Jackshaft:

1. Size:

a. 1-inch diameter.

2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.

2. Include center hole to suit damper operating-rod size.

3. Include elevated platform for insulated duct mounting.

2.7 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Pottorff.

3. Ruskin Company.

4. Young Regulator Company.

5. United Enertech

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Section:

a. Hat shaped.

2. Material:

a. 20 GA 0.40-inch- thick galvanized steel .

3. Corners:

a. Mitered-and-welded.

D. Blades: Multiple.

1. Maximum blade width:

a. 6 inches.

2. Opposed -blade design.

3. Material:

a. Galvanized-steel.

4. Thickness:

a. 20 GA 0.40-inch- thick galvanized steel

5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

a. Closed-cell neoprene

E. Blade Axles:

1. Section:

a. 3/8-inch-square

2. Material:

a. Galvanized steel.

3. Blade-linkage hardware:

a. Zinc-plated steel and brass.

b. Ends sealed against blade bearings:

4. Operating Temperature Range: From minus 25 to plus 185 deg F.

F. Bearings:

1. Type:

a. Molded synthetic.

2. Axles: Dampers in ducts with pressure classes of 3-inch wg or more shall have axles full length of damper blades.

3. Bearings: Thrust bearings at each end of every blade. Bearings at both ends of each operating shaft.

2.8 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arrow United Industries; a division of Mestek, Inc.

2. Greenheck Fan Corporation.

3. Nailor Industries Inc.

4. Pottorff.

5. Ruskin Company.

6. United Enertech

B. Type:

1. Dynamic.

C. Standard: Rated and labeled according to UL 555 by an NRTL.

D. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

E. Fire Rating:
   1. 1-1/2 hours.
F. Frame:
   1. Curtain type with blades outside airstream.
   2. Material:
      a. Fabricated with roll-formed galvanized steel; with mitered and interlocking corners.
      b. Thickness:
         1) 20GA-0.040-inch-.
G. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel. Length to suit application.
   1. Minimum Thickness:
      a. 18GA-0.05 inch, as indicated.
   2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
H. Mounting Orientation: Vertical or horizontal as indicated.
I. Blades: Roll-formed, interlocking, galvanized sheet steel.
   1. Thickness:
      a. 24GA-0.024-inch-
   2. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
J. Horizontal Dampers: Include blade lock and Type 301 constant force stainless-steel closure spring.
K. Heat-Responsive Device: Replaceable, 212 deg F rated, fusible links.
L. Accessories:
   1. Auxiliary switches for signaling:
      a. Position indication.

2.9 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Greenheck Fan Corporation.
   2. Nailor Industries Inc.
   3. Pottorff.
   4. Ruskin Company.
   5. United Enertech
B. General Requirements: Label according to UL 555S by an NRTL.
C. <u>Smoke Detector: See electrical for smoke detector requirements.</u>
C. Frame: Galvanized sheet steel. With or without mounting flange as required.
   1. Thickness:
      a. Hat-shaped, 16GA-0.064-inch.
   2. Corners:

a. Welded.

D. Blades: Horizontal, galvanized sheet steel.

1. Section;

a. Roll-formed.

2. Fit:

a. Interlocking.

3. Thickness:

a. 14GA-0.079-inch.

E. Leakage:

1. Class II.

F. Seals:

1. Blade: Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450 deg F.

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

1. Minimum 17-inches long.

2. Thickness:

a. 0.05-inch-.

I. Damper Motors: Damper motors to be Belimo or approved equal. Honeywell motors are not allowed.

1. Action:

a. Two-position

2. Mode: Fail close.

3. Mounting: External.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Electrical Connection: 115 V, single phase, 60 Hz .

K. Accessories:

1. Auxiliary switches for signaling:

a. Position indication.

2. Test Switch type:

a. Momentary test switch.

3. Test Switch Mounting:

a. Damper.

2.10 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Nailor Industries Inc.

3. Pottorff.
4. Ruskin Company.
5. United Enertech

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum velocity of:
1. 4000-fpm

D. Fire Rating:
1. 1-1/2 hours.

E. Frame: Hat shaped, galvanized sheet steel. With or without mounting flange as required.
1. Thickness:
a. 16GA-0.064-inch
2. Corners:
a. Welded.

F. Heat-Responsive Device: Replaceable, 212 deg F rated, fusible links.

G. Blades: Horizontal, galvanized sheet steel.
1. Type:
a. Air-foil.
2. Fit:,
a. Interlocking.
3. Thickness:
a. 0.063-inch-.

H. Leakage:
1. Class I.

I. Rated pressure and velocity to exceed design airflow conditions.

J. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
1. Thickness:
a. 18GA 0.05-inch-.

K. Master control panel for use in dynamic smoke-management systems.

A. L. Damper Motors: Damper motors to be Belimo or approved equal. Honeywell motors are not allowed.
1. Locate outside air stream unless otherwise indicated,
2. Action:
a. Two-position.
3. Voltage: to match fire alarm system (coordinate).
4. Listed: UL, as part of damper assembly.
5. Outdoor Motors and Motors in Outside-Air Intakes:
a. Gaskets: O-ring gaskets designed to make motors weatherproof.
b. Internal heaters: Equip to permit normal operation at minus 40 deg F .

B. M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Electrical Connection: 115 V, single phase, 60 Hz.

N. Accessories:

2. Auxiliary switches:

a. Signaling.

b. Position indication.

3. Test Switch type:

a. Momentary test switch.

4. Test Switch Mounting:

a. Damper.

2.11 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Industrial Acoustics Company.

2. Ruskin Company.

3. SEMCO Incorporated.

4. Vibro-Acoustics.

B. General Requirements:

1. Factory fabricated.

2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.

3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Shape:

1. Rectangular straight with splitters or baffles.

2. Round straight with center bodies or pods.

3. Rectangular elbow with splitters or baffles.

4. Round elbow with center bodies or pods.

5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: Galvanized sheet steel.

1. ASTM A 653:

a. G60.

2. Thickness:

a. 22GA-0.034 inch.

E. Round Silencer Outer Casing: Galvanized sheet steel.

1. ASTM A 653:

a. G60.

2. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 22GA-0.034 inch thick.

3. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 20GA-0.040 inch thick.
4. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 18GA-0.05 inch thick.
5. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 16GA-0.064 inch thick.

F. Inner Casing and Baffles: Galvanized sheet metal with 1/8-inch- diameter perforations.
1. ASTM A 653:
a. G60.
2. Thickness:
a. 22GA-0.034 inch.

G. Special Construction:
1. Suitable for outdoor use.
2. High transmission loss to achieve STC 45.

H. Connection Sizes: Match connecting ductwork unless otherwise indicated.

I. Principal Sound-Absorbing Mechanism:
1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
2. Dissipative or Film-lined type with fill material:
a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 15 percent compression
b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.
c. Prohibited: Mineral wool will not be permitted as a substitute for glass fiber.
3. Lining:
a. Material:
1) Tedlar
b. Prohibited: Mesh, screen or corrugated perforated liner will not be acceptable as a substitute for the specified spacer.

J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
1. Joints:
a. Lock formed and sealed.
2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
3. Reinforcement: Cross or trapeze angles for rigid suspension.
4. Structural Criteria: The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gage.
5. Spot Welds: All spot welds shall be painted.

K. Accessories:
1. Integral 1-1/2-hour fire damper with access door. Access door to be high transmission loss to match silencer.
2. Factory-installed end caps to prevent contamination during shipping.
3. Removable splitters.
4. Airflow measuring devices.

2.12 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. METALAIRE, Inc.
2. SEMCO Incorporated.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Fabricate single blade vanes to comply with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible."
2. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction:

1. Single wall

F. Vane Spacing:

1. 1-1/2" spacing between turning vanes
2. 3-1/4" spacing not allowed.

G. Vane Construction: Single wall for ducts up to 36 inches wide and additional bracing for larger dimensions.

2.13 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff.
2. Ruskin Company; Tomkins PLC.

B. Cable Type:

1. Description: Cable system designed for remote manual damper adjustment.
2. Tubing/Sheathing: Galvinsed, Brass, Copper or Aluminum.
3. Cable: Stainless steel or Steel.
4. Wall-Box Mounting: Coordinate with Architect.
5. Wall-Box Cover-Plate Material: Coordinate with Architect.

C. Activated Electric Type:

1. Description: Electrically activated zone control damper for remote adjustment. When an adjustment is needed the system is powered up.
2. Means: Factory mounted actuator factory wired to damper.
3. Portable 9 volt system. No field power requirement.
4. Mounting: Recessed Wall Box or Diffuser or Hand Held.
5. Wall-Box Cover Finish: Coordinate with Architect.

6. Wall-Box Porting: 1 to 6 ports or more.

2.14 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Greenheck Fan Corporation.
   2. McGill AirFlow LLC.
   3. Pottorff.
   4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
   5. Ruskin Company

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
   1. Door:
      a. Double wall, rectangular.
      b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
      c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
      d. Fabricate doors airtight and suitable for duct pressure class.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
   3. Number of Hinges and Locks:
      a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
      b. Access Doors up to 18 Inches Square:
         1) Hinges:
            a) Two hinges and two sash locks.
      c. Access Doors up to 24 by 48 Inches, provide outside and inside handles:
         1) Hinges:
            a) Three hinges and two compression latches.
      d. Access Doors Larger Than 24 by 48 Inches, provide outside and inside handles:
         1) Hinges:
            a) Continuous and two compression latches with outside and inside handles.

2.15 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductmate Industries, Inc.
   2. Ventfabrics, Inc.
   3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a wide fabric strip attached to two narrower metal strips. Provide strips of metal compatible with connected ducts.

1. Wide Strip:
   a. 3-1/2 inches.
2. Narrow Strips:
   a. 0.028-inch- thick, galvanized sheet steel.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.16 DUCT SECURITY BARS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carnes.
2. KEES, Inc.
3. Lloyd Industries, Inc.
4. Metal Form Manufacturing, Inc.
5. Price Industries.
6. Titus
7. Krueger

B. Description: Factory-fabricated and field-installed duct security bars.

C. Configuration:
1. Frame: 1-1/2 by 1-1/2 by 3/16 inch angle.
2. Sleeve: 3/16-inch, continuously welded steel frames with 1-1/2-by-1-1/2-by-1/8- angle frame furnished loose for field welding on other end. To be poured in place or set with concrete block or welded or bolted to wall, one side only. Duct connections on both sides.
3. Horizontal Bars: 3/4 inch steel.
4. Vertical Bars: 3/4 inch steel
5. Bar Spacing: 6 inches.
6. Mounting: Ductwork or other framing.

D. Finish:
1. White

2.17 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.

3. Themaflex
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Ducts shall conform to the requirements for Class I connectors when tested in accordance with "Standard for Factory Made Air Ducts Materials and Air Duct Connectors" (UL 181).

C. Ducts shall also pass the 15 minute U.L. flame penetration test as specified in the UL 181 Standard.

D. Insulated, Flexible Duct: Two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

E. Flexible Duct Connectors:

1. Clamps: in sizes 3 through 18 inches, to suit duct size.
   a. Material: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action.

2.18 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

C. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

D. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.

2.19 HIGH EFFICIENCY TAKE-OFFS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.

1. Air-Rite
2. Hercules Industries
3. Sheet Metal Connectors, Inc.
4. Spiral Manufacturing Co. Inc.
5. Ferguson

B. Materials:

1. 26 gauge galvanized sheet metal meeting ASTM A653 and A924

C. Take-off shall meet SMACNA third edition Section 4.8 figure 4.6 - 45 degree entry.

D. Rectangular opening with flanged sides on all sides. Complete with closed cell neoprene gasket
to provide a tight seal.

E. Zeros VOC's

PART 3 - EXECUTION

3.1 INSTALLATION

General

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Use the Remote Damper Operator when they are called out on the drawings or when the damper cannot be easily accessed.

D. Install duct security bars. Construct duct security bars from 3/16-inch steel sleeve, continuously welded at all joints and 3/4-inch- diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 1-1/2-by-1-1/2-by-1/8- steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.

E. Install high efficiency take-off on all branch duct take-offs. Provide take-off with balancing damper as shown on drawings. Spin-in fittings are not allowed.

Flexible Ducts / Flexible Duct Connectors

F. Install flexible connectors to connect ducts to equipment.

G. Flexible duct connections from the main trunk ducts to diffuser boots shall be furnished and installed as shown on the drawings. Flexible ductwork shall only be used as indicated on the drawings.

H. Where flexible duct is indicated, use insulated flexible duct for supply air return and exhaust air.

I. Flexible ductwork shall be run in straight lengths.

J. Provide support in flexible duct every three feet.

K. Flexible ducts shall have compression fittings on both ends.

L. Flexible ductwork is not allowed to bend 90 degrees. If a bend is needed use sheet-metal hard elbows. Hard turns, offsets, or kinks will not be allowed.

M. Flexible ducts shall connect to trunk duct with high efficiency takeoffs.

N. Connect flexible ducts to metal ducts with draw bands.

O. Connect ducts to duct silencers:

1. With flexible duct connectors.

P. Connect terminal units to supply ducts:

1. With maximum 12-inch lengths of flexible duct.

Q. Do not use flexible ducts to change directions.

R. Connect diffusers or light troffer boots to ducts:

1. With maximum 60-inch lengths of flexible duct clamped or strapped in place.

Backdraft/Control/Pressure Relief Dampers

S. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

T. Install pressure relief damper immediately upstream of main fire damper.

Volume Damper

U. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.

V. Set dampers to fully open position before testing, adjusting, and balancing. Exception: Pressure relief damper.

W. A balance damper with locking quadrant will be provided downstream of take-off from trunk duct.

Fans And Test Holes

X. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

Y. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

Z. Install duct test holes where required for testing and balancing purposes.

AA. Install test holes at fan inlets and outlets and elsewhere as indicated.

FIRE, SMOKE AND FIRE-SMOKE DAMPERS

BB. Install fire and smoke dampers according to UL listing.

1. Install fusible links in fire dampers.

CC. For round ductwork 24-inch and smaller a true round fire damper with the same rating may be used.

Access Doors

DD. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On upstream side of duct coils.

2. Upstream from duct filters.

3. At outdoor-air intakes and mixed-air plenums.

4. At drain pans and seals.

5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be standard access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

7. At each change in direction and at maximum 50-foot spacing.

8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.
12. On upstream side of duct reheat coils. (between Phoenix valve and reheat coil)

EE. Install access doors with swing against duct static pressure.

FF. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

GG. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

3.3 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. inal positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 233300

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 233423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Utility set fans.
2. Centrifugal roof ventilators.
3. Centrifugal wall ventilators.
4. Ceiling-mounted ventilators.
5. In-line centrifugal fans.
6. Propeller fans.
7. Dryer booster fans

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on:

1. Actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

C. Fan Schedule: Fan characteristics and performance data are described in an equipment schedule on the drawings including:

1. Fan arrangement with wheel configuration, inlet and discharge configurations, and required accessories.
2. Capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, shipping weights, operating weights, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.
   a. Detail all wiring systems and differentiate clearly between manufacturer-installed and field-installed wiring.

C. Delegated-Design Submittal: For unit hangars and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
   1. Roof framing and support members relative to duct penetrations.
   2. Ceiling suspension assembly members.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control Reports

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Belts: One set for each belt-driven unit.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Power ventilator electrical components shall comply with applicable NEMA standards.

D. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 PRODUCTS FURNISHED BUT NOT INSTALLED

A. Products furnished, but not installed, under this Section include roof curbs for roof-mounted exhaust fans. Roof curbs to be installed by Division 07, section "Roof Accessories".

2.2 UTILITY SET FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aerovent; a division of Twin City Fan Companies, Ltd.
2. Greenheck Fan Corp.
3. Hartzell Fan Incorporated.
4. Loren Cook Company.
5. New York Blower Company (The).
6. PennBarry.
7. Twin City

B. Housing: Fabricated of steel with side sheets fastened with a deep lock seam or welded to scroll sheets.

1. Housing Discharge Arrangement: Adjustable to eight standard positions.

C. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.

1. Blade Materials:
   a. Steel
2. Blade Type:
   a. Airfoil

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves.

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9:
   a. L_{-50} of 200,000 hours.
   b. External Lubrication Lines: Lubricating tubes from fan bearings extended to accessible location outside of fan housing.
3. Belt drives factory mounted, with final alignment and belt adjustment made after installation
4. Service Factor Based on Fan Motor Size:
   a. 1.5
5. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
6. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
7. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
8. Fan Guard: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet and/or outlet on units not connected to ductwork, where contact with fan wheel is within personal reach through access opening, or where falling objects and/or debris may enter fan.

E. Accessories:

1. Inlet Screens: Removable wire mesh.
2. Disconnect Switch: Nonfusible type:
   a. Thermal-overload protection; factory wired through an internal aluminum conduit.
      1) Mounted inside fan housing.

2.3 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Aerovent; a division of Twin City Fan Companies, Ltd.
   2. Greenheck Fan Corporation.
   3. Loren Cook Company.
   4. PennBarry.
   5. Twin City.

B. Housing: Removable: Square, one-piece, aluminum base with venture inlet cone.
   1. Spun-aluminum, dome top and outlet baffle.
   2. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains [and grease collector].
   3. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels:
   1. Aluminum hub and wheel with backward-inclined blades.

D. Direct-Drive Units: Motor mounted outside of airstream within fan housing.

E. Belt-Driven Units: Motor mounted on adjustable base, adjustable sheaves and with motor and belts within fan housing.

F. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Disconnect Switch: Nonfusible type:
      a. Thermal-overload protection; factory wired through an internal aluminum conduit.
         1) Mounted inside fan housing.
   3. Bird Screens: Removable, 1/2-inch mesh:
      a. Aluminum wire.
   4. Dampers:
      a. Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
      b. Motorized parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base. Provide neoprene gasket between fan base and curb to reduce sound transmission.
   1. Configuration:
      a. Self-flashing without a cant strip, with mounting flange.

2. Overall Height:
   a. 14 inches.

H. KITCHEN CENTRIFUGAL UPBLAST EXHAUSTERS
1. Spark-Resistant Construction: AMCA 99, Type B.
2. Refer to Division 23 Section "Motors" for general requirements for factory-installed motors.

2.4 CENTRIFUGAL WALL VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aerovent; a division of Twin City Fan Companies, Ltd.
2. Ammerman; Millennium Equipment.
3. Greenheck Fan Corporation.
4. Hartzell Fan Incorporated.
5. Loren Cook Company.
6. PennBarry.
7. Twin City.

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.
1. Fan Guard: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet on units not connected to ductwork, where contact with fan wheel is within personal reach through access opening, or where falling objects and/or debris may enter fan.

D. Direct-Drive Units: Motor mounted in airstream.

E. Accessories:
1. Disconnect Switch: Nonfusible type:
   a. Thermal-overload protection; factory wired through an internal aluminum conduit.
      1) Mounted outside fan housing.
2. Bird Screens: Removable, 1/2-inch mesh:
   a. Aluminum wire.
3. Wall Grille: Ring type for flush mounting.
4. Dampers:
   a. Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

2.5 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. PennBarry.
4. Twin City.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: With flange on intake and thumbscrew attachment to fan housing.

1. Painted steel.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

2.6 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Hartzell Fan Incorporated.
3. Loren Cook Company.
4. PennBarry.
5. Twin City.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing with:

1. Wheel, inlet cone.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

1. Fan Guard: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet on units not connected to ductwork, where contact with fan wheel is within personal reach through access opening, or where falling objects and/or debris may enter fan.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Dampers:
   a. Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
4. Disconnect Switch: Nonfusible type:
   a. Thermal-overload protection; factory wired through an internal aluminum conduit.
      1) Mounted inside fan housing.

2.7 PROPELLER FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aerovent; a division of Twin City Fan Companies, Ltd.
2. Hartzell Fan Incorporated.
3. Loren Cook Company.
4. New York Blower Company (The).

5. PennBarry.
6. Twin City.

B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

C. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

D. Fan Drive:
1. Motor mounted in airstream
2. Resiliently mounted to housing.
3. Statically and dynamically balanced.
4. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
5. Service Factor Based on Fan Motor Size: 1.4.
6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.
8. Fan Guard: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet on units not connected to ductwork, where contact with fan wheel is within personal reach through access opening, or where falling objects and/or debris may enter fan.

E. Accessories:
1. Motorized Damper: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
2. Disconnect Switch: Nonfusible type:
   a. Thermal-overload protection; factory wired through an internal aluminum conduit.
      1) Mounted outside fan housing.

2.8 DRYER BOOSTER FANS (UL listed)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following;
1. American Aldes
2. Fantech
3. Reversomatic Manufacturing Ltd.
4. Spruce Environmental Technologies Inc.
5. Tjernlund Products Inc.

B. Housing:
1. G90 galvanized steel or thermoplastic.

C. Wheel:
1. Backward incline
2. Self Cleaning.

D. Positive Pressure Switch:
1. Positive pressure switch to start fan when dryer starts.

2. Switch pressure set to 0.05 inches of water column
3. Integrated timer in switch to maintain fan performance until drying cycle is complete.

E. Motor:
1. 120 volt
2. Permanently sealed self lubricating
3. Automatic reset thermal overload protection
4. Acceptable for continuous duty.

2.9 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed;
1. Fan cooled

2.10 FACTORY FINISH

A. Metal Parts: All assembly parts shall be protected from rust and corrosion.
1. Stainless steel, aluminum, and other non-corroding materials require no protective finish.
2. Non-galvanized sheet metal parts shall be prime coated or powder coated before final assembly.
3. Prime coated parts shall receive baked enamel finish coat after assembly.

2.11 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements of installation tolerances and other conditions affecting performance of the power ventilators. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements. Verify clearances.

B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

3.3 INSTALLATION

A. Install power ventilators level and plumb according to manufacturer's written instructions.

B. Base Mounted Equipment:

1. Install power ventilators on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in:
   a. Division 33 "Cast-in-Place Concrete."

C. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.

D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

E. Support Steel: Support suspended units from structure using threaded steel as specified in Division 23 "Vibration and Seismic Controls for HVAC."

F. Label units according to requirements specified in Division 23 "Identification for HVAC Piping and Equipment."

G. Install power ventilators with factory recommended and code required clearances for service and maintenance.

H. Install dryer booster fan per manufacturer’s instructions.

3.4 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 "Grounding and Bonding for Electrical Systems."
   1. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Connect wiring according to Division 26 "Low-Voltage Electrical Power Conductors and Cables."
   1. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Division 23 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

3.7 CLEANING

A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

B. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."

C. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

D. Demonstrate operation of power ventilators. Conduct walking tour of the Project. Briefly identify location and describe function, operation, and maintenance of each power ventilator.

END OF SECTION 233423

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 233600

AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.

1. Air terminal units.
2. Liners and adhesives.
3. Sealants and gaskets.
4. Seismic-restraint devices.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams:
   a. For power, signal, and control wiring.
   b. Differentiate between manufacturer-installed and field-installed wiring.
3. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

D. Delegated-Design Submittal:

1. Materials, fabrication, assembly, and spacing of hangers and supports.
2. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.

E. Airborne noise data for terminal units serving Patient Rooms:

1. Declared discharge and radiated sound power levels by octave band covering a minimum range of 63 to 4000 hertz
2. Method of determining declared sound power levels.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Size and location of initial access modules for acoustic tile.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Air terminal units shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan-Powered-Unit Filters: Furnish one spare filter for each filter installed.

1.8 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. Product Options: Drawings and schedules indicate requirements of air terminals and are based on specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

C. Listing and Labeling: Provide electrically operated air terminals specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

D. NFPA Compliance: Install air terminals according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

E. Comply with NFPA 70 for electrical components and installation.

F. Airborne Noise:

1. Comply with ANSI / AHRI 880 - Performance Rating of Air Terminals

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

B. Airborne Noise:

1. Maximum sound power levels by octave band in decibels referenced to on picowatt:

AHU	Source	Sound Power Level by Octave Band (Hz), dBL (re 10^{-12} W)						
		63	125	250	500	1000	2000	4000
VAV Box serving Patient Rooms	Discharge	71	69	69	62	54	50	47
	Radiated	60	60	58	50	40	36	33

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Products; a Mestek Company.
2. Carnes.
3. Environmental Technologies, Inc.
4. Krueger.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Price Industries.
8. Titus.
9. Trox USA Inc.; a subsidiary of the TROX GROUP.
10. Tuttle & Bailey.
11. Warren Technology.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch steel, single wall.

1. Casing Lining: Adhesive attached, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
   a. Lining thickness:
      1) 1/2-inch-
   b. Cover liner with nonporous foil.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Air Outlet: S-slip and drive connections size matching inlet size.
5. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
6. (LEED) Airstream Surfaces: Surfaces in contact with the airstream shall comply with

requirements in ASHRAE 62.1.

7. Access Door: Access door upstream of the reheat coil.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage:

a. ARI 880 rated, 3 percent of nominal airflow at 3-inch wg inlet static pressure.

2. Damper Position:

a. Normally open.

E. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

F. Direct Digital Controls: See Section 230900 “Instrumentation and Controls for HVAC”.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Steel Cables: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.5 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to ARI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

D. Install discharge air temperature sensors at the outlet of each Air Terminal Unit.

E. Connect ductwork to air terminals according to Division 23 ductwork Sections.

F. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 230548 "Vibration and Seismic Controls for HVAC."

G. For Diffuser Type Air Terminal Units, provide and install all necessary control wiring and control voltage transformer. See drawings AND schedules for additional information.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

A. Install piping adjacent to air terminal unit to allow service and maintenance.

B. Hot-Water Piping: In addition to requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Connect ducts to air terminal units according to Section 233113 "Metal Ducts.

D. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

E. Electrically ground all equipment:

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Air terminal unit will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Cleaning:

1. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to:

a. Manufacturer's written instructions.

b. Construction documents.

2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.

3. Verify that controls and control enclosure are accessible.

4. Verify that control connections are complete.

5. Verify that nameplate and identification tag are visible.

6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units:

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

2. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."

3. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

4. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

END OF SECTION 233600

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 233713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections:

1. Section 233714 "Fixed Louvers" for fixed and louvers and wall vents, whether or not they are connected to ducts.

2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

3. Section 230594 "General Testing, Adjusting and Balancing" for balancing diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.

2. Method of attaching hangers to building structure.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

5. Duct access panels.

B. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated.

B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

C. Airborne Noise:

1. Comply with ANSI / AHRI 880 - Performance Rating of Air Terminals

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Factors

2. Carnes.

3. Kruegar.

4. METALAIRE, Inc.

5. Nailor Industries Inc.

6. Price Industries.

7. Titus.

8. Tuttle & Bailey.

9. AJ ManufacturingREGISTERS, GRILLES, & DIFFUSERS

B. General: The frames for all registers, grilles, and diffusers shall match type of ceiling where they are to be installed. Special frames shall be provided for narrow T-bar ceilings. Refer to reflected ceiling plan and other specification divisions for ceiling type. See drawings AND schedules for additional information.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, coordination drawings, original design, and referenced standards.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION 233713

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 233714

FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum louvers.

B. Related Requirements:

1. Section 099113 "Exterior Painting" for field painting louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Design Spectral Response Acceleration at Short Periods: Per the structural drawings and specifications.

2. Component Importance Factor: 1.5.

B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Airolite Company, LLC (The).

b. Pottorff.

c. Ruskin Company; Tomkins PLC.

2. Louver Performance Ratings:

a. Free Area: Not less than 8.5 sq. ft. for 48-inch- wide by 48-inch- high louver.

b. Point of Beginning Water Penetration: Not less than 1250 fpm.

c. Air Performance – intake: Not more than 0.10-inch wg static pressure drop at 900-fpm free-area velocity.

d. Air Performance – exhaust: Not more than 0.15-inch wg static pressure drop at 1000-fpm free-area velocity.

3. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.

2. Screening Type: Bird screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.

2. Finish: Same finish as louver frames to which louver screens are attached.

3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Contractor shall use Phillips flat-head or hex-head or Phillips pan-head screws for exposed fasteners screws for exposed fasteners unless otherwise indicated.

2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame

members necessary.

2.7 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Color Anodic Finish: AAMA 611, or thicker.

1. Color: As selected by Architect from full range of industry colors and color densities.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weather-tight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 233714

SECTION 233723

HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Roof hoods.
2. Goosenecks.

B. Products furnished, but not installed, under this Section include roof curbs for roof-mounted exhaust fans.

1.03 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Ventilators, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

1.04 ACTION SUBMITTALS

A. Product Data:

1. For each type of product indicated.[For louvered-penthouse ventilators specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

2. Drawings from each manufacturer detailing equipment assemblies. Indications of dimensions, loadings, required clearances, method of field assembly, components and location and size of each field connection.

3. Rated capacities of each unit, weights (shipping, installed and operating), furnished specialties, accessories and the following:

a. Material gages and finishes, including color charts.
b. Dampers, including housings, linkages and operators.

4. LEED Submittals:

a. Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

C. Delegated-Design Submittal: For shop-fabricated ventilators indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of shop-fabricated ventilators.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which roof curbs and ventilators will be attached.
2. Sizes and locations of roof openings.

B. Seismic Qualification Certificates: For ventilators, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Welding certificates.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.07 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.02 FABRICATION, GENERAL

A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.03 ROOF HOODS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Mfg. Corporation.
2. Aerovent.
3. Carnes.
4. Greenheck Fan Corporation.
5. JencoFan.
6. Loren Cook Company.
7. PennBarry.

B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.

C. Materials: Aluminum sheet, minimum 0.063-inch- thick base and 0.050-inch- thick hood; suitably reinforced.

D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip and mounting flange.
2. Overall Height: 14 inches.

E. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.051-inch wire.

F. Capacities and Characteristics:

1. Air Performance: Not more than 0.10-inch wg static pressure drop at 600-fpm free-area exhaust or intake velocity.

2.04 GOOSENECKS

A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 6-5; with a minimum of 0.052-inch- thick, galvanized-steel sheet.

B. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 24 inches.

C. Bird Screening: Stainless-steel, 1/2-inch- square mesh, 0.047-inch wire.

D. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.

3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

   a. Color and Gloss: As selected by Architect from manufacturer's full range.

E. Capacities and Characteristics:

1. Height: 24 inches.
2. Width and Depth: 26 inches by 26 inches.
3. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area intake velocity.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements of installation tolerances and other conditions affecting performance of the equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Install goosenecks on curb base where throat size exceeds 9 by 9 inches.

C. Install gravity ventilators with clearances for service and maintenance.

D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 079200 "Joint Sealants" for sealants applied during installation.

F. Label gravity ventilators according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.03 CONNECTIONS

A. Duct installation and connection requirements are specified in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts." Drawings indicate general arrangement of ducts and duct accessories.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

3.05 CLEANING

A. Clean interiors to remove foreign material, dirt and construction debris.

3.06 DEMONSTRATION

A. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventative maintenance.

B. Review data in the operation and maintenance manuals.

C. Schedule training with Owner, through Architect with at least seven (7) days' advance notice.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 235100

BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL.

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Listed single and double-wall vents.
2. Field-fabricated metal breechings.
3.

4. POSITIVE PRESSURE FLUES
   a. Listed:
      1) Single-wall vents.
      2) Double-wall vents.
   b. Field-fabricated metal breechings.

5. B & BW VENTS
   a. Listed:
      1) Single-wall vents.
   b. This section specifies flues for:
      1) Gas appliances requiring a negative pressure in the flue at all times;
         a) Water Heaters.
         b) Atmospheric Boilers.
         c) Other boilers.

6. CATEGORY IV, CONDENSING BOILERS, SPECIAL GAS VENTS
   a. Listed:
      1) Double-wall vents.
   b. This section specifies:
      1) Category IV vents/chimneys.
      2) Special Gas Units.
      3) Condensing Boilers – positive pressure.

B. Related Sections include the following:

1. Section 235113 "Draft Control Devices" for induced-draft and mechanical fans and for motorized and barometric dampers.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Chimney liners.
2. Type B and BW vents.
3. Type L vents.
4. Special gas vents. (Category IV, Condensing Boilers, Special Gas Vents).
5. Building-heating-appliance chimneys. (Forced Draft Boilers) .
6. Grease ducts.
7. Refractory-lined metal breechings and chimneys.
8. Guy wires and connectors.

B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and seismic restraints, and location and size of each field connection.
2. For installed products indicated to comply with design loads, include calculations required for selecting seismic restraints and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Manufacturer Seismic Qualification Certification: Submit certification that factory-fabricated breeching, chimneys, and stacks; accessories; and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Breeching, Chimneys, and Stacks: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of anchorage devices on which the certification is based and their installation requirements.

C. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain listed system components through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.

C. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

D. Verification: Flue type to be verified by the boiler manufacturer of the submitted boiler.

1.06 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, structural failures caused by expansion and contraction.

1. Warranty Period: To cover the following number of years from date of Substantial Completion:
   a. 10 years.

PART 2 - PRODUCTS

2.01 LISTED TYPE B AND BW VENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ampco.
2. Cleaver-Brooks.
3. Metal-Fab, Inc.
4. Schebler Co. (The).
5. Selkirk Corporation; Selkirk Metalbestos and Air Mate.
6. Simpson Dura-Vent Co., Inc.
7. Van-Packer Company, Inc.

B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B, or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.

C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

D. Inner Shell:
   1. ASTM B 209, Type 1100 aluminum

E. Outer Jacket:
   1. Galvanized steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

   1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
   2. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.
   3. Termination: Exit cone with drain section incorporated into riser.
   4. Termination: Antibackdraft.

2.02 LISTED SPECIAL GAS VENTS (POSITIVE PRESSURE FLUES)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   1. Heat-Fab, Inc.
   2. Z-Flex; a division of the Novaflex Group.
   3. Duravent
   4. Ampco

B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211.

C. Vent shall be factory-built special gas type, double wall, engineered and designed for use on Category IV appliances, or as specified by the equipment manufacturer.

D. Maximum continuous flue gas temperature not to exceed 550° F for gas burning appliances.

E. Construction: Inner conduit and outer wall casing shall be constructed with a one-inch air space between them and in such a fashion that prevents cross-alloy contamination. Optional 1” fiber insulation is available to maintain higher flue temperatures, but does not reduce clearances beyond the standard clearances tested for 1” air space model CI Plus.

F. Inner Shell: Vent shall be constructed with an inner conduit constructed of ASTM A 959, Type 29-4C or 2904 superferritic stainless steel with a minimum thickness of 0.015” for diameters of 3”to 8”, 0.20” for diameters of 10” to 16”, 0.025 for diameters 18” to 24”, and 0.035” for 26” and greater.

G. Outer Jacket: The outer wall casing shall be constructed of 430 stainless steel that shall not require additional surface preparation, such as painting, in order to withstand the outdoors or high humidity environments.

H. The joint closure shall be an inner wall mechanical locking strap design. Joints shall not use screws or fasteners that penetrate the inner conduit.

I. General Electric RTV105 or Down Corning 736 high temperature sealant shall be used to seal all joints on systems where the maximum flue gas temperature will not exceed 550° F or a factory installed 550° F compatible silicone rubber gasket shall be used to seal joints.

J. Vent shall be listed for an internal static pressure of 15” w.g. and tested to 37” w.g.

K. Vent shall be constructed with a factory installed gasket used to seal the joint for diameters 4” to 16”. Use of gasket lube, available from the factory, should be used for maximizing gasket life and ease of installation. For diameters 18” to 32”, joints shall be sealed with factory supplied RTV sealant.

L. Tees and elbows shall provide a pressure drop less than 15 feet equivalent horizontal vent.

M. Fittings that increase or decrease vent diameter shall be asymmetric in construction with a flat wall that maintains a straight line with adjoin parts in order to facilitate the unobstructed flow of all condensate.

N. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
2. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.
3. Termination: Exit cone with drain section incorporated into riser.

O. All parts shall be compatible with other single wall and double wass products of the same manufacturer.

P. System is to be sized in accordance with the appliance manufacturer’s specifications, NFPA 54 National fuel Gas Code (ANSI Z223.1), ASHREA recommendations, and other applicable codes.

2.03 LISTED BUILDING-HEATING-APPLIANCE CHIMNEYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cleaver-Brooks.
2. Metal-Fab, Inc.
3. Schebler Co. (The).
4. Selkirk Corporation.
5. Simpson Dura-Vent Co., Inc.

A. Description: Double-wall metal vents tested according to UL 103 and rated for 1000 deg F continuously, or 1700 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.

B. Construction:

1. Inner shell and outer jacket separated by an annular space of at least:

a. 2-inch.

2. Filled with:

a. Confined air.
b. High-temperature, ceramic-fiber insulation.

C. Inner Shell: ASTM A 666, stainless steel.
1. Type 304.

D. Description: Double-wall metal vents tested according to UL 103 and UL 959 and rated for 1400 deg F continuously or 1800 deg F for 10 minutes; with positive or negative flue pressure complying with NFPA 211.

E. Construction: Inner shell and outer jacket separated by at least the following annular space filled with high-temperature, ceramic-fiber insulation:

1. 2-inch.

F. Outer Jacket:
1. Galvanized steel.

G. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
2. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.
3. Termination: Exit cone with drain section incorporated into riser.

2.04 FIELD-FABRICATED METAL BREECHINGS AND CHIMNEYS

A. Fabricate freestanding chimneys according to SMACNA's "Guide for Steel Stack Design and Construction." (See Drawings for Dimensions).

B. Fabricate breechings and chimneys from ASTM A 1011/A 1011M hot-rolled steel with continuously welded joints, complying with NFPA 211 for minimum metal thickness.

1. Equal to or Less Than 1.069 Sq. Ft. or 14 Inches in Diameter: 0.053 inch.
2. Up to 1.396 Sq. Ft. or 16 Inches in Diameter: 0.067 inch.
3. Up to 1.764 Sq. Ft. or 18 Inches in Diameter: 0.093 inch.
4. Larger Than Above: 0.123 inch.

C. Fabricate chimneys and vent connectors from galvanized steel, complying with NFPA 211 for minimum metal thickness.

1. Equal to or Less Than 6 Inches in Diameter: 0.019 inch.
2. Up to 10 Inches in Diameter: 0.024 inch.
3. Up to 16 Inches in Diameter: 0.029 inch.
4. Larger Than Above: 0.056 inch.

D. Fabricate chimneys and vent connectors from ASTM B 209, Type 1100 or 3003, aluminum or stainless steel, complying with NFPA 211 for the following minimum metal thicknesses:

1. Aluminum: 0.027 inch.
2. Stainless Steel: 0.012 inch.

E. Fabricate cleanout doors from compatible material, same thickness as breeching, bolted and gasketed.

A. Fabricate engine exhaust:

1. From ASTM A 53, Type E (electric-resistance welded), Grade B; or ASTM A 106, Type S, Grade B, pipe;
   a. Schedule 40.

2. With welded joints and carbon-steel fittings and flanges.

3. With wrought-Steel Fittings: ASME B16.9, wall thickness to match adjoining pipe.
4. With wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, Class 150, including bolts, nuts, and gaskets.

2.05 GUYING AND BRACING MATERIALS

A. Cable: Three galvanized, stranded wires of the following thickness:

1. Minimum Size: 1/4 inch in diameter.
2. For ID Sizes 4 to 15 Inches: 5/16 inch.
3. For ID Sizes 18 to 24 Inches: 3/8 inch.
4. For ID Sizes 27 to 30 Inches: 7/16 inch.
5. For ID Sizes 33 to 36 Inches: 1/2 inch.
6. For ID Sizes 39 to 48 Inches: 9/16 inch.
7. For ID Sizes 51 to 60 Inches: 5/8 inch.

B. Pipe: Two galvanized steel, NPS 1-1/4.

C. Angle Iron: Two galvanized steel, 2 by 2 by 0.25 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATION

A. Listed Type B and BW Vents: Vents for certified gas appliances.

B. Listed Special Gas Vent: Condensing gas appliances.

C. Listed Building-Heating-Appliance Chimneys: Dual-fuel boilers, oven vents, water heaters, and exhaust for generator engines. Fireplaces and other solid-fuel-burning appliances.

D. Field-Fabricated Metal Breechings and Chimneys: Dual-fuel boilers, oven vents, water heaters, exhaust for fireplaces and other solid-fuel-burning appliances.

3.03 INSTALLATION OF LISTED VENTS AND CHIMNEYS

A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

B. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.

E. Lap joints in direction of flow.

3.04 INSTALLATION OF UNLISTED, FIELD-FABRICATED BREECHINGS AND CHIMNEYS

A. Suspend breechings and chimneys independent of their appliance connections.

B. Install, support, and restrain according to seismic requirements.

C. Align breechings at connections, with smooth internal surface and a maximum 1/8-inch misalignment tolerance.

D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.

E. Lap joints in direction of flow.

F. Support breechings and chimneys from building structure with bolts, concrete inserts, steel expansion anchors, welded studs, C-clamps, or beam clamps according to manufacturer's written instructions.

3.05 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

B. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.

C. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 235700

HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes gasketed-plate heat exchangers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Plate removal space.
2. Structural members to which heat exchangers will be attached.

B. ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of domestic-water heat exchangers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including heat exchanger, storage tank, and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Plate, Domestic-Water Heat Exchangers:

1) Plate-and-Frame Type: One year.

2) Brazed Plate Type: One year

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Heat exchangers shall withstand the effects of earthquake motions determined according to 230548 “Vibration and Seismic Controls for HVAC and ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.02 GASKETED-PLATE HEAT EXCHANGERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps, Inc.
2. Delta T Heat Exchangers.
3. ITT Corporation.
4. Mueller, Paul, Company.
5. TACO Incorporated.
6. Kelvion
7. Wessels

B. Description: Factory-packaged assembly of nonfixed-position, heat-exchanger plates, with frame, for using heating hot water to heat domestic water.

C. Working-Pressure Rating: 150 psig (1035 kPa).

D. Frame:
1. Carrying and Guide Bars: Stainless steel
2. Fixed, Frame Plate; Pressure Plate; Support Column; and Nuts and Bolts: Carbon steel.

E. Channel Plates:
1. Type: Double wall.
2. Material: Stainless steel.
3. Plate Thickness: Not less than 0.024 inch (0.6 mm).
4. Gasket Material: Butyl or acrylonitrile-butadiene rubber, suitable for potable water.

F. Connections: Stainless steel, suitable for potable water.
1. NPS 2 (DN 50) and Smaller: Threaded.
2. NPS 2-1/2 (DN 65) and Larger: Flanged.

G. Protective Shroud: Steel, covering channel plates.

H. Insulation: Complying with ASHRAE/IES 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire heat exchanger, except connections.

I. Required Connections: Domestic cold water in; domestic hot water out; heating hot water supply in; heating hot water out.

J. Capacity and Characteristics: See schedule.

2.03 BRAZED-PLATE HEAT EXCHANGERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alfa Laval
2. Armstrong

B. Configuration: Brazed assembly, consisting of embossed or pressed stainless steel plates brazed together and two end plates, one with threaded nozzles and one with pattern-embossed plates. Floor-mounted heat exchangers must have factory-furnished integral legs with mounting feet.

C. Construction: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.

D. End-Plate Material: Type 316 stainless steel.

E. Threaded Nozzles: Type 316 stainless steel.

F. Plate Material: Type 316 stainless steel.

G. Brazing Material: Copper

H. Retain one option in “Brazing Material” Paragraph below. Copper is most common.

2.04 ACCESSORIES

A. Hangers and Supports:

1. Custom, steel supports for mounting on:
   a. Floor.

2. Ensure both horizontal and vertical support of heat exchanger by providing:
   a. Factory-fabricated steel supports.

3. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Shroud:
1. Steel sheet.

C. Miscellaneous Components for High-Temperature Hot-Water Unit: Control valve, valves, and piping.

D. Pressure Relief Valves:
1. Cast iron
2. ASME rated and stamped.

2.05 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect heat exchangers according to ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1. Affix ASME label.

B. Hydrostatically test heat exchangers to minimum of one and one-half times pressure rating before shipment.

C. Heat exchangers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

B. Examine roughing-in for heat-exchanger piping to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 GASKETED-PLATE HEAT-EXCHANGER INSTALLATION

A. Install gasketed-plate heat exchanger on custom-designed wall supports anchored to structure as indicated on Drawings.

B. Install metal shroud over installed gasketed-plate heat exchanger according to manufacturer's written instructions.

3.03 CONNECTIONS

A. Comply with requirements for piping specified in other;
   1. Section 232113 "Hydronic Piping."
   2. Section 232116 “Hydronic Piping Specialties."
   3. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Maintain manufacturer's recommended clearances for tube removal, service, and maintenance.

C. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.

D. Install shutoff valves at heat-exchanger inlet and outlet connections.

E. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.

F. Install hose end valve to drain shell.

G. Install thermometer on heat-exchanger and inlet and outlet piping, and install thermometer on heating-fluid inlet and outlet piping.

H. Comply with requirements for thermometers specified in Section 230519 "Meters and Gages for HVAC Piping."

I. Install pressure gages on heat-exchanger and heating-fluid piping. Comply with requirements for pressure gages specified in Section 230519 "Meters and Gages for HVAC Piping."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Heat exchanger will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers.

END OF SECTION

BLANK PAGE

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 236424

PACKAGED AIR-TO-WATER HEAT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

Section Includes:

1. Packaged, air-cooled air-to-water heat pump units.

1.3 DEFINITIONS

COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

DDC: Direct digital control.

EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by AHRI 550/590 and referenced to AHRI standard rating conditions.

kW/Ton (kW/kW): The ratio of total power input of the unit in kilowatts to the net refrigerating capacity in tons (kW) at any given set of rating conditions.

NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by AHRI 550/590 and intended for operating conditions other than AHRI standard rating conditions.

1.4 ACTION SUBMITTALS

Product Data: For each type of product.

1. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
2. Performance at AHRI standard conditions and at conditions indicated.
3. Performance at AHRI standard unloading conditions.
4. Minimum flow rate.

5. Refrigerant capacity of unit.
6. Oil capacity of unit.
7. Fluid capacity.
8. Characteristics of safety relief valves.
9. Minimum entering condenser-air temperature.
10. Maximum entering air temperature.
11. Performance at varying capacities with constant-design, entering air temperature. Repeat performance at varying capacities for different entering condenser-air temperatures from design to minimum in 10 deg F increments.

Shop Drawings:

12. Include plans, elevations, sections, and attachment details.
13. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
14. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural supports.
2. Piping roughing-in requirements.
3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

Product Certificates: For certification required in "Quality Assurance" Article.

Seismic Qualification Data: Certificate, for units, accessories, and components, from manufacturer.

5. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
6. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
7. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Source quality-control reports.

Field Test Reports: Include startup service reports.

Sample Warranty: For AHRI special warranty.

1.6 CLOSEOUT SUBMITTALS

Operation and Maintenance Data: For each unit to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

AHRI Certification: Certify according to AHRI 590 certification program(s).

AHRI Rating: Rate unit performance according to requirements in AHRI 550/590.

ASHRAE Compliance:

1. ASHRAE 15 for safety code for mechanical refrigeration.
2. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.

ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

ASME Compliance: Fabricate and label unit to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.

Comply with NFPA 70.

Comply with requirements of UL and UL Canada and include label by a qualified testing agency showing compliance.

1.8 DELIVERY, STORAGE, AND HANDLING

Ship each unit with a full charge of refrigerant. Charge each unit with nitrogen if refrigerant is shipped in containers separate from unit.

Ship each oil-lubricated unit with a full charge of oil.

1. Ship oil in containers separate from unit.

1.9 WARRANTY

Manufacturer's Warranty: Manufacturer shall provide full parts-only warranty coverage for entire unit for a period of one year. All parts shall be warranted against defects in material and workmanship. Similar parts-only coverage shall be provided for the units compressors for a period of five years. The warranty period shall commence either on the equipment start-up date or six months after shipment, whichever is earlier.

1.10 GENERAL

Units are leak tested, pressure tested, then evacuated and charged. All chillers are factory tested prior to shipment. Units ship with a full operating charge of oil and refrigerant as standard. Units can also be shipped with a nitrogen charge if required. Unit panels, structural elements and control boxes are constructed of

galvanized steel and mounted on a bolted galvanized steel base. Unit panels, control boxes and the structural base are finished with a baked on powder paint.

PART 2 - PRODUCTS

2.1 Operating Conditions

Provide outdoor packaged Air-to-Water liquid Heat Pump with the capacity as scheduled on drawings at job site elevation listed.

Heat Pump shall be designed to operate using R454B Refrigerant.

Heat Pump shall be designed for parallel load water flow.

Heat pump shall be designed for variable capacity either in heating or cooling operation

The liquid to be chilled/heated will be water containing corrosion inhibitors and antifreeze solution as required.

2.2 Outdoor Packaged Air-to-Water Heat Pump

Approved manufacturers

1. Trane
2. Multistack - Airstack.
3. TSI
4. Aermec

Refrigeration Circuit

5. All chiller sizes are designed with two refrigerant circuits. Each refrigeration circuit includes two or three scroll compressors, a compressor suction and discharge service valve, liquid line shutoff valve, removable core filter, liquid line sight glass with moisture indicator, charging port and an electronic expansion valve.

Evaporator

6. Braze plate heat exchanger is made of stainless steel with copper as the braze material. It is designed to withstand a refrigerant side working pressure of 650 psig and a waterside working pressure of 150 psig. Evaporator is tested at 1.1 times maximum allowable refrigerant side working pressure and 1.5 times maximum allowable water side working pressure. Immersion heaters protect the evaporator to an ambient of -20°F (-29°C). The evaporator is covered with factory-installed 0.75 inch (19.05 mm) Armaflex II or equal (k=0.28) insulation. Foam insulation is used on the suction line.

Condenser and Fans

7. The air-cooled microchannel condenser coils are used with all aluminum brazed fin construction. For ACXA units, the round tube plate fin (RTPF) coils are used with aluminum fin constructions. The condenser coil has an integral subcooling circuit. The maximum

allowable working pressure of the condenser is 650 psig. Condensers are factory proof and leak tested at 1.1 times maximum allowable refrigerant side working pressure. Coils can be cleaned with high pressure water. Direct-drive vertical-discharge airfoil condenser fans are dynamically balanced. The condenser fan motors are permanent magnet motors with integrated drive to provide variable speed fan control for all fans. Chillers are equipped with EC or AC condenser fan motors with permanently lubricated ball bearings and internal thermal and overload protection.

Compressor

8. The unit is equipped with two or more hermetic, direct-drive, 3600 rpm 60 Hz suction gas-cooled scroll compressors with intermediate discharge valve to increase seasonal efficiency. Overload protection is included. The compressor includes: centrifugal oil pump, oil level sight glass and oil charging valve. Each compressor will have compressor heaters installed and properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

Unit Controls

9. All unit controls are housed in an outdoor rated weather tight enclosure with removable plates to allow connection of power wiring and remote interlocks. All controls, including sensors, are factory mounted and tested prior to shipment.

10. Microcomputer controls provide all control functions including start-up and shutdown, leaving chilled water temperature control, evaporator flow proving, compressor staging and speed control, electronic expansion valve modulation, condenser fan sequencing and speed control, anti-recycle logic, automatic lead/lag compressor starting, and load limiting.

Controller

11. The controller is an application-specific, programmable controller that is factory installed and designed to control packaged HVAC equipment. A 7-inch user interface features a touch-sensitive color screen that provides facility managers with at-a-glance operating status, performance monitoring, scheduling changes and operating adjustments. Other advanced features include automated controller backup and optional features such as secure remote connectivity, wireless building communications, and custom programming with expandable I/O.

12. The control module, utilizing Adaptive Control™ microprocessor, automatically takes action to avoid unit shutdown due to abnormal operating conditions associated with low refrigerant pressure, high condensing pressure, AFD/Compressor current overload, low oil return or low AFD cooling, low discharge superheat, and high compressor discharge temperature. Should the abnormal operating condition continue until a protective limit is violated, the unit will be shutdown. Unit protective functions of the controller include: loss of chilled water flow, evaporator freezing, loss of refrigerant, low refrigerant pressure, high refrigerant pressure, high compressor motor temperature, and loss of oil to the compressor. The controller supports standard BACnet communication protocol through a RS485, two wire communication link or BACnet/IP over Ethernet.

13. A full color touch screen display indicates all important unit and circuit parameters, in logical groupings on various screens. The parameters including chilled water setpoint, leaving evaporator temperature, demand limit setpoint, evaporator and condenser refrigerant temperatures and pressures, compressor and fan speeds, and all pertinent electrical information. The display also provides “on screen” data graphs of predefined parameters as well as customizable data graphs based on user defined parameters from a list of all

available parameters. The display also provides indication of the chiller and circuits' top level operating modes with detailed sub-mode reports available with a single key press, as well as diagnostics annunciation and date and time stamped diagnostic history. The color display is fully outdoor rated, and can be viewed in full daylight without opening any control panel doors.

14. Standard power connections include main three phase power to the compressors, condenser fans and control power transformer and optional connections are available for the 115 volt/60 Hz single phase power for the thermostatically controlled evaporator heaters for freeze protection.
    a. Outdoor capable:
        1) UV Resistant Touchscreen
        2) Operating Temperature: -40°C to 70°C
        3) IP56 rated (Power Jets of Water from all directions)
    b. RoHS Compliant
    c. UL PAZX, Open Energy Management Equipment
    d. CE Certification
    e. Emissions: EN55011 (Class B)
    f. Immunity: EN61000 (Industrial)
    g. Display:
        1) 7-inch diagonal
        2) 800x480 pixels.
        3) TFT LCD @ 600 nits brightness
        4) 16 bit color graphic display
    h. Display Features:
    i. Alarms
        1) Reports
        2) Unit Settings
        3) Display Settings
    j. Graphing
    k. Global Application with Support for 27 Languages

Chilled Water Reset

15. Control logic and factory installed sensors are provided to reset leaving chilled water temperature. The set point can be reset based on ambient temperature or return evaporator water temperature.

Factory Mounted Flow Proving and Flow Control

16. The factory installed evaporator water flow switch is provided with the control logic and relays to turn the chilled water flow on and off as the chiller requires for operation and protection. This function is a requirement on the chiller.

High Ambient

17. High ambient option permits high ambient (up to 125°F [51.7°C]) operation. Low side ambient remains 32°F (0°C).

Water Reversing Valve Assembly

18. The water reversing valve assembly incorporates two 3-way valves with two actuators and associated piping. This option can provide a much higher heating efficiency. The actuators

have integrated linkage and provides 90° rotation with a visual indicator. The valves are controlled by controller.

Circuit Breaker

19. A HACR rated molded case capacity circuit breaker (UL approved) is available. Circuit breaker can also be used to disconnect chiller from main power with a through-the-door handle.

BACnet® Communications Interface

20. Allows the user to easily interface with BACnet via a single twisted pair or Ethernet wiring to a factory installed controller.

Acoustic Package

21. Each compressor includes a factory installed acoustical treatment.

Convenient Outlet

22. Provides a 20 amp, 115V (60 Hz) convenience outlet on the unit.

Drain Pan

23. The drain pan is used to collect the defrost water during heating mode and convey to customer plumbing system. Drain pan can be removed for on site cleaning and re-installed.

PART 3 - INSTALLATION

3.1 EXAMINATION

Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Examine roughing-in for piping and electric installations for water-source heat pumps to verify actual locations of piping connections and electrical conduits before installation.

Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Equipment Mounting:

Install heat pumps on cast-in-place concrete equipment base(s) or support rails. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

3.3 CONNECTIONS

Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Connect supply and return hydronic piping to heat pump with piping accessories per heat pump detail

Install electrical devices furnished by manufacturer but not specified to be factory mounted.

Install piping adjacent to machine to allow service and maintenance.

Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

Perform the following field tests and inspections:

1. After installing water-source heat pumps and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Heat pumps will be considered defective if they do not pass tests and inspections.

Prepare test and inspection reports.

3.5 PIPING SYSTEM FLUSHING PROCEDURE

Prior to connecting the Heat Pump to the building Load water loop, the piping shall be flushed with a detergent and hot water (110-130° F) mixture to remove previously accumulated dirt and other organic residue. In old piping systems with heavy encrustation of inorganic materials consult a water treatment specialist for proper passivation and/or removal of these contaminants.

During the flushing a 30 mesh (max.) Y-strainers (or acceptable equivalent) shall be in place in the system piping and examined periodically as necessary to remove collected residue. The use of on board strainers shall not be acceptable. The flushing process shall take no less than 6 hours or until the strainers, when examined after each flushing, are clean. Old systems with heavy encrustation shall be flushed for a minimum of 24 hours and may take as long as 48 hours before the filters run clean. Detergent and acid concentrations shall be used in strict accordance with the respective chemical manufacturer’s instructions. After flushing with

the detergent and/or dilute acid concentrations the system loop shall be purged with clean water for at least one hour to ensure that all residual cleaning chemicals have been flushed out.

Prior to supplying water to the Heat Pump the Water Treatment Specification shall be consulted for requirements regarding the water quality during Heat Pump operation. The appropriate Heat Pump manufacturer's service literature shall be available to the operator and/or service contractor and consulted for guidelines concerning preventative maintenance and off-season shutdown procedures.

3.6 WATER TREATMENT REQUIREMENTS

Supply water for the load water circuit shall be analyzed and treated by a professional water treatment specialist who is familiar with the operating conditions and materials of construction specified for the Heat Pump's heat exchangers, headers and associated piping. Cycles of concentration shall be controlled such that recirculated water quality for modular Heat Pumps using 316 stainless steel brazed plate heat exchangers and carbon steel headers is maintained within the following parameters:

1. pH Greater than 7 and less than 9
2. Total Dissolved Solids (TDS) Less than 1000 ppm
3. Hardness as $CaCO_3$ 30 to 500 ppm
4. Alkalinity as Ca $CO_3$30 to 500 ppm
5. Chlorides Less than 200 ppm
6. Sulfates Less than 200 ppm

3.7 START-UP

Manufacturer shall provide the services of a Factory Authorized Service Engineer to provide complete start-up supervision. Factory Authorized Service Engineer shall also be responsible for assembly of the units cabinetry package and electrical bus bar system. After start-up a Manufacturer's Representative shall provide a minimum of 8-hours of operator training to the owner's designated representative(s).

END OF SECTION

BLANK PAGE

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 237313

CUSTOM AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Custom indoor air-handling units.

1.3 PERFORMANCE REQUIREMENTS

A. Sound Power Levels: Submit sound power level data (discharge opening, inlet opening and radiated through casing) for each air handling unit. The submittal shall include complete description of methods and procedures used to develop the sound power data.

B. Retain paragraph below with "Seismic Qualification Certificates" Paragraph in "Informational Submittals" Article for projects requiring seismic design. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Verify requirements of authorities having jurisdiction.

C. Seismic Performance: Air-handling units shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Seismic certificates will require the units to be made without humidifiers. Humidifiers can be installed in the field by others but will not be covered under the certificate. If this is acceptable include humidifiers to be field installed on the schedule.

3. Submit manufacturer's certification that the equipment is seismically qualified by:

a. An engineered analysis conforming to the requirements of Chapter 13 of ASCE 7.

b. Testing by a nationally recognized testing standard procedure such as ICC-ES AC 156. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.

c. Experience data conforming to a nationally recognized procedure. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.

1.4 ACTION SUBMITTALS

A. Product Data: For each air-handling unit indicated.

1. Unit dimensions and weight.

2. Cabinet material, metal thickness, finishes, insulation, and accessories.

3. Fans:

a. Certified fan-performance curves with system operating conditions indicated.

b. AMCA 311 Certified fan-sound power ratings.

c. Fan construction and accessories.

d. Motor ratings, electrical characteristics, and motor accessories.

4. Certified coil-performance ratings with system operating conditions indicated.

5. Dampers, including housings, linkages, and operators.

6. Filters with performance characteristics.

7. Casing design calculations for project's largest air handling unit.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.

2. Support location, type, and weight.

3. Field measurements.

B. Seismic Qualification Certificates: For air-handling units, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

4. Testing is acceptable without the humidifier. Humidifier to be shipped separately and installed in the field.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish additional materials that match products as installed in the delivered air handlers and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Two sets for each air-handling unit; one set to be used during startup and Test & Balance; one set to be installed by the Contractor at Substantial Completion.

1.8 QUALITY ASSURANCE

A. ETL Labeling: List and label units by ETL. If ETL listing and labeling is not available, UL listing and labeling will be acceptable. No other agency listings or labels can be substituted without detailed submittal, review and acceptance in writing. If any is delivered to the site without such label, the manufacturer shall pay all costs to have ETL or UL field certification accomplished and the labels registered and field applied with a field certification report prepared by either agency

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ARI Certification: Air-handling unit components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

D. First paragraphs below may be required to comply with Project requirements or authorities having jurisdiction. LEED Prerequisite IEQ 1 requires compliance with requirements in ASHRAE 62.1, including requirements for controls, surfaces in contact with the airstream, particulate and gaseous filtration, humidification and dehumidification, drain pan construction and connection,

finned-tube coil selection and cleaning, and equipment access. Verify, with manufacturers, the availability of units with components and features that comply with these requirements.

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

F. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

G. AMCA 311.05 Certified Ratings Program - Product Rating Manual for Fan Sound Performance.

H. Comply with NFPA 70.

I. Air Handling units and major components shall be product of Manufacturing firms regularly engaged in manufacture of equipment with characteristics and capacities as scheduled and whose products have been in satisfactory and similar service for not less than 3-years and must have a minimum of 10 working installations that have been in operation for a least 2-years. Manufacturer must have in-house engineering support.

J. Airborne Noise:

1. ANSI / AMCA 300 - Test Code for Sound Rating Air Moving Devices

2. ANSI / AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices

3. ANSI / AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

C. Coordinate anchor bolts, concrete base thickness and bolt edge setback required by Section 230248 Vibration Isolation and Seismic Restraint.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide York Custom Air Handlers or comparable product by one of the following manufacturers:

1. Air Handlers

    a. Huntair

    b. Climate Craft

    c. Energy Labs

    d. Governair

    e. Haakon

    f. Temtrol

    g. Unitech

    h. York Custom

2. Fan Array Assemblies

    a. Climate Craft

    b. Huntair

    c. Twin City

    d. York Custom

    e. Temtrol

    f. Energy Labs

3. Control Dampers

    a. Ruskin Model CD50.

    b. Greenheck Model VCD-43.

    c. Tamco Series 1000.

2.2 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Casings shall be double-wall acoustical-thermal panels.

2. Casings shall meet the requirements of the current International Energy Conservation Code (IECC).

3. Casing panel shall be self-supporting and capable of withstanding 8" of static pressure, without panel joints exceeding a deflection of L/200 where "L" is the unsupported span length within the completed Casing. For the project's largest air handler, submit design calculations, signed by the manufacturer, to certify compliance with the Cabinet and Casing design requirements.

4. Casing leakage shall not exceed 1 percent of the design flow rate at 133 percent of the design static pressure as scheduled on the Plans.

5. Sealing: Seal all joints with water-resistant sealant.

6. Manufacturer's standard finish (interior and exterior) is acceptable for indoor air handlers, unless otherwise specified.

7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

8. The Sound Power Level, as measured or calculated, at the air-handler discharge opening, the inlet opening and transmitted through the casing shall not exceed, for each octave band, values scheduled on the Plans.

B. Casing Insulation:

1. Materials: ASTM C 1071, Type II.

2. Location and Application: Completely encased between outside and inside casing. A finish bead of caulking will be applied inner liner panel seams to completely encapsulate the insulation.

C. Base Construction:

1. Unit base shall be constructed of structural steel tube or channel shapes framing around the entire perimeter of the unit and provided with intermediate structural tubing or channel shapes as required to support the internal components. All tubing and channel joints shall be solid welded. Base shall be provided with removable lifting lugs minimum (4) per section, located to assure uniform loading.

2. The unit base shall be covered with minimum 16 gauge steel floor with caulked and screwed seams and the manufacturer's standard finish. Floor shall be welded to unit base perimeter and intermediate structural tubing or channel shapes.

3. The floor of the Base shall be insulated with minimum 2-inches of sprayed polyurethane

foam insulation.

4. All opening in the floor greater than one square foot, including openings with dampers, shall be covered with a removable steel grate, bolted in place. Steel floor grates shall have manufacturer's standard finish. Grates shall be capable of supporting minimum 300 pounds with grate bars spaced to prevent personnel and large objects from fall into duct or space below air handler.

D. Interior liners; to minimum 22 gage steel with manufacturer's standard solid finish throughout the unit for the walls and roof.

E. Inspection and Access Panels and Access Doors:

1. Panel and Door Fabrication: Formed and reinforced double-wall and insulated panels of same materials, thicknesses and finish as the unit casing.

2. Inspection and Access Panels:

a. Fasteners: Two or more camlock type for panel lift-out operation.

b. Arrangement: Shall allow panels to be opened against air-pressure differential.

c. Gasket: Replaceable, neoprene, bulb-type applied around entire perimeters of panel frames.

d. Size: Sufficient to allow inspection and maintenance of air-handling unit's internal components.

3. Access Doors:

a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.

b. Gasket: Replaceable, neoprene, bulb-type applied around entire perimeters of panel frames.

c. c. Windows in Doors: Double-glazed, safety glass with an air space between panes and sealed with interior and exterior neoprene seals. Minimum window size: 10-inch by 10-inch. Doors with access to moving parts must meet current UL mechanical protection guidelines.

d. Door Size: Minimum 18 inches wide by full height of unit casing up to a maximum height of 72 inches. In the fan section, the door width must be sufficient for removal and replacement of a fan/motor assembly.

4. Locations and Applications:

a. Fan Section: Doors with windows (large enough to allow remove/replacement of fan through door).

b. Access Section: Doors with windows.

c. Coil Section: Doors with windows.

d. Damper Section: Doors with windows.

e. Filter Section: Doors large enough to allow periodic removal and installation of filters.

f. Mixing Section: Doors with windows.

F. Lights and Control Wiring

1. Fabricate air handler to allow minimum 1.5-inch clearance above the entire width of the each interior header-wall (coils, filters, fan septum-wall, etc.). This space is reserved for internal wiring (120-volt or 24-volt) as required by the Controls Contractor.

2. All factory wiring to lights, switches and convenience outlets shall be in conduit and internal to the air handler. No external conduit runs are allowed.

3. Service Lights: Vapor proof, LED A21 Lamp, 14-watt, light fixtures in each accessible section complete with a protective metal cage and sealed enclosure. Wire all lights to a common external junction box with a single illuminate switch, 120-volt GFCI outlet and weatherproof cover.

G. Condensate Drain Pans:

1. Fabricated with minimum one percent slope (1/8” per foot) in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and to direct water toward drain connection.

a. Length: Extend drain pan H/2 from leaving face in the direction of the air flow, where “H” is the vertical height of the cooling coil, to comply with ASHRAE 62.1 Section 5.

b. Depth: Minimum of 2-inch deep.

2. Drain pan shall be fully recessed into the air handler floor.

3. Double-wall, 304-stainless steel sheet solid welds of all joints, seams and corners with space between walls filled with foam insulation and moisture-tight seal.

4. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan. Extend through channel/tube base on same side as coil connections unless noted otherwise on Plans.

a. Minimum Connection Size: MNPS 1-1/4.

5. Drain pan shall conform to all applicable requirements in ASHRAE 62.1.

6. Coils shall be easily removable without cutting or removing any portion of the drain pan.

7. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil with drain pipe extending to lower pan to eliminate splashing.

8. Drain pan shall be provided for all cooling coils.

9. Provide manufacturer's certification Drain Pan testing to demonstrate proper drainage in compliance with ASHRAE 62.1 paragraph 7.3 which permits factory or field testing.

2.3 MULTIPLE FAN ARRAY UNITS

A. The Multiple Fan Array shall consist of multiple direct-driven Arrangement 4 plenum fans constructed and designed specifically for Multiple Fan Array applications.

B. All fans shall be selected to deliver design air flow at the specified operating Total Static Pressure at the specified motor speed as scheduled in the Plans. The Multiple Fan Array shall be selected to operate at a system Total Static Pressure that does not exceed 90 percent of the specified fan's peak static pressure producing capability at the specified fan speed.

C. All motors shall be IEEE inverter-duty permanent magnet (premium efficiency motors will be considered as an alternate design) T-frame motors selected at the voltage, frequency, and rpm as scheduled on the Plans.

D. All fan motors shall be provided with a factory installed Shaft Grounding mechanism. Motor shaft isolation bearings, ceramic bearings and other SGR systems require Prior Approval from the Engineer.

E. Each fan/motor assembly shall be removable through the fan section access door.

F. Multiple fan installations must have a minimum of two fans. The individual motor size shall not exceed 10.0 horsepower.

G. Fans should have backdraft dampers on the inlets to prevent airflow cross circulating in the event of a fan turned off.

H. Fan Backdraft Dampers:

1. Each fan applied in multiple fan applications shall be provided with an integral back flow prevention device that prohibits recirculation of air in the event a fan, or multiple fans, become disabled. The system effect for the submitted back flow prevention device shall be included in the calculation to determine the fan TSP for fan selection purposes, and shall be indicated as a separate line item SP loss in the submitted fan selection data. Manufacturers other than the basis of design being submitted must provide independent lab certification of fan testing that indicates the system effects attributed to the submitted back flow prevention device in the submitted close coupled mounting arrangement at the inlet of the fan. Fans submitted with discharge dampers will not be approved.

2. Back Draft Damper performance data that is based on an AMCA ducted inlet and ducted discharge mounting configuration will not be accepted. Submitted Back flow prevention device data must be reflective of close coupled mounting at the intake of the fan(s) per the project design documents. Motorized dampers or other motorized devices submitted for back flow prevention are not acceptable. AHU Manufacturers that do not manufacture the fans being submitted must provide tested and certified performance data for fans as installed in the AHU unit including the back draft damper system effects introduced by close coupled back draft dampers at the fan inlet.

I. Electrical:

1. Each fan/motor assembly shall be individually wired its own Variable Frequency Drive (VFD). Each VFD shall be wired to individual overload protection, short circuit protection and a manual disconnect that allows for independent operation of each fan/motor assembly in the multiple fan array.

2. Provide an Electrical Control Panel that includes:

   a. Variable Frequency Drives for each fan/motor assembly; Option to have the VFD mounted directly on the fan cell

   b. Individual overload protection, short circuit protection and a manual disconnect for each fan/motor assembly;

   c. Overload protection, short circuit protection and a manual disconnect for three-points of electrical connection for the entire air handling unit. Supply fan array, return fan array and lighting.

3. Electrical designs, wiring and hardware shall be in accordance with the current NEC, UL 508C and local codes.

4. Control Panel shall be listed and labeled by UL, CSA or ETL

5. Control Panel shall be mounted on the exterior of the air handler.

6. Provide axillary contacts for alarm connections to the Building Management System.

7. Electrical Control Panel shall be rated NEMA 1 Indoor force ventilated enclosure with

filtered intake, louver covered exhaust opening(s); hinged doors.

8. Label and number code all wiring and electrical devices in accordance with the unit electrical diagram.

J. Each induction motor in the FANWALL unit shall be driven off a dedicated variable frequency drive that is programmed and tested at the factory. Acceptable drives are the FANWALL Technology Drive, **ABB ACS320** and Yaskawa V1000. The motor shall have permanently lubricated sealed or double-shielded ball bearings. The motor shall incorporate a means to mitigate induced shaft currents to prevent electrical arcing across bearing races and balls via a contacting grounding stick. Fiber type grounding devices are not permitted.

2.4 VARIABLE FREQUENCY DRIVES

A. General: Requirements:

1. Variable Frequency Drives (VFD) shall meet requirements of IEEE 519 as measured at VFD system terminals.

2. Provide VFD and fan/motor assembly as one coordinated package, warrantied by VFD supplier.

3. VFD System shall be solid state AC to DC converter sinusoidal pulse-width modulation (PWM) type. Each fan motor shall have its own VFD.

4. Unit shall operate on:

   a. Input Voltage 460/3/60.

   b. Input frequency 60 Hz, plus or minus 5 percent.

5. All components of system shall be contained in single enclosure as integrated package.

6. Control power for operator devices and customer connections shall be 120 volts. Control power transformer shall be ‘Machine Tool’ type and have primary and secondary fusing.

7. VFD’s shall be rated for continuous current equal to 105 percent of motor FLA.

8. Rated overload current shall be 120 percent for one minute.

9. Unit shall be adjustable accel / decel time setting from one second to 120 seconds.

10. Unit shall maintain 95 percent or better displacement power factor over entire speed range.

B. Variable Frequency Drive Inverter:

1. Altitude compensated and sized for project elevation.

2. Capable of operating in ambient temperature of 14 deg F to 122 deg F and humidity of 0 percent to 90 percent non-condensing.

3. Mounted on removable panel along with other components so panel can be removed from enclosure for maintenance or part replacement.

4. Output frequency clamp on drive for setting minimum or maximum output frequency.

5. Supply with door interlock input to disconnect motor circuit protector. Door mounted handle shall be able to lock in OFF position.

C. Controls And Safety Equipment:

1. Provide, as minimum, following door mounted operator controls:

a. HAND / OFF / AUTO Switch.

b. Local / Remote Selector.

c. Frequency Setting Speed Selector.

d. Frequency Indication Meter calibrated in percent speed.

e. Power on Light.

f. VFD / Bypass Switch. Not required with individual drives. If drive goes down replace. Don’t Bypass

g. VFD Fault Light.

h. External Fault Light (safeties interlock).

i. Digital Keypad Programmable Parameter Unit (75 hp and less).

2. Provide minimum of following protective features with alarm display indication:

a. Over-current shut-off.

b. Regenerative over voltage.

c. Electronic Thermal Protector.

d. Heatsink Overheat.

e. Instantaneous Power Failure.

f. Output Ground Fault (Actual phase to phase or phase to ground without damage).

3. Provide following termination points on terminal strip for field connections:

a. Safeties Interlock.

b. Remote Start / Stop Contact.

c. Remote VFD Fault Contact.

d. Remote VFD / Bypass Enable Contact.

e. Remote Electronic Signal Input.

4. Auto Restart shall be initiated by means of automatic time delayed restart after recovering from under voltage or loss of power. Inverter shall not automatically restart after over-current, over-voltage, over-temperature, or other damaging conditions, but shall require manual restart.

5. Frequency Jump: Supply drive with capability of being field retrofitted with frequency jump control to avoid operating at point of resonance with natural frequency of machine.

6. Provide VFD unit with computer signal control option through future RS 232 data card. Or BACnet interface.

7. Fault Diagnostics: Drive system shall have non-volatile fault retention so VFDs fault history is available from memory even after power loss. Coordinate with the Controls Contractor

D. Manufacturer's Field Services:

1. Provide field start-up service by authorized factory service representative consisting of system check-out, start-up, and system run.

2. Provide certificate of completion and authorized factory service including operator training and start-up.

E. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. FANWALL Technology drives supplied by Mechanical Products Intermountain, Midvale, UT (801-352-9003)

2. Yaskawa Electric America, Inc. supplied by Long Building Technologies, Murray, UT (801) 330-8236.

3. Rockwell Automation, Inc. Allen-Bradley Brand (ABB) supplied by Midgley Huber, Salt Lake City, UT (801) 972-5011

4. Toshiba International Corp E3 supplied by Applied Automation, Salt Lake City, UT (801) 486-8791.

5. Danfoss VLT 6000 Series supplied by Mechanical Products Intermountain, Midvale, UT (801-352-9003)

6. Mitsubishi A/F 500 Series supplied by Energy Management Corp, Salt Lake City, UT (800) 433-4548.

2.5 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with ARI 410.

2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).

3. Coils shall not act as structural component of unit.

B. Hot Water, Chilled Water and Glycol Coils

1. ASHRAE Compliance: Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

2. Performance Ratings: Tested and rated according to AHRI 410 and ASHRAE 33.

3. Minimum Working-Pressure/Temperature Ratings: 250 psig, 325 deg F.

4. Source Quality Control: Factory tested to 400 psig.

5. Tubes: ASTM B 743 copper, minimum 0.625 inch diameter, minimum 0.035 inch thick. Expanded into fin collars to provide permanent mechanical bond

6. Return Bends: Brazed replaceable copper, minimum 0.049 inch thick,

7. Fins: Aluminum, minimum 0.008 inch thick.

8. Headers: Seamless copper tube with brazed joints, prime coated, with cleaning plugs and drain and air vent tappings. Provide braze or copper male thread connections. Connections shall be on the same end of the coil. Extend vent and drain fitting to exterior of casing.

9. Frames: Galvanized-steel channel frame, minimum 0.064 inch thick for flanged mounting.

10. All coils shall be fully drainable with no trapped tube.

11. Supply and return connections shall be raised/lowered to facilitate piping connections near roof, floor and stacked coils. Coils shall be counter-flow design with connections right/left hand as shown on Plans. Use of internal flow restrictive devices, such as turbulator, springs, ribbons, is not acceptable. Provide intermediate coil casing reinforcement so maximum unsupported coil length is 60-inches.

12. Stacked coils to be mounted with integral stacking flanges on the coil.

13. Coil supply and return piping connections extending through the cabinet wall shall be sealed by caulking and escutcheons inside and outside of the casing.

2.6 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.

2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

3. Filter section shall be fabricated as an integral part of the air handling unit. Filter shall be upstream face loading as indicated on Plans. Face or rear loading shall be in gasketed universal holding frames. The filter rack assemblies shall blanked off to the sides, roof and floor and sealed to minimize filter bypass.

4. Provide filter holding frames arranged for flat or angular orientation, as indicated on Plans, with access doors, as indicated on Plans. Filters shall be lifted out from the access plenum.

5. See Filter Schedule on Plans for filter configuration and maximum filter face velocity.

B. Extended-Surface, Disposable Panel Filters:

1. Pleated disposable type, UL listed Class 2

2. Thickness: 2 inches.

3. MERV (ASHRAE 52.2-2007): 8 & 16. Reference Filter Schedule on drawings

4. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.

5. Media-Grid Frame: Nonflammable cardboard.

6. Mounting Frames: Welded, galvanized steel, with gaskets and fasteners, suitable for

bolting together into built-up filter banks.

C. Filter Gage:

1. Dwyer 2000 Magnehelic gage; in metal case.

2. Black figures on white background.

3. Front recalibration adjustment.

4. 2 percent of full-scale accuracy.

5. Range: 0- to 2.0-inch w.g.

2.7 DAMPERS

A. General Requirements for Dampers: Low leak airfoil dampers bearing the AMCA Seal.

B. Air performance and air leakage shall be based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Rating Program. Damper shall be AMCA Leakage Class 1A, 3.0 cubic feet per minute leakage at 1.0 inch w.g. pressure; AMCA Leakage Class 1, 8.0 cubic feet per minute leakage at 4.0 inch w.g. pressure difference through a 48-inch by 48-inch damper. Maximum blade length shall be 48-inches.

2.8 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

C. Water Coils: Factory tested to 400 psig and to 200 psig underwater according to ARI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Units that are required to ship in multiple sections shall be assembled per manufacturer's written instructions under the direction of a factory authorized representative.

B. Equipment Mounting:

1. Install air-handling units on cast-in-place concrete equipment bases. Obtain a copy of the Vibration and Seismic Controls Submittal. Concrete equipment bases shall comply with overall size, thickness, and edge distance for anchor bolts required in Submittal.

2. Comply with requirements for equipment bases and foundations specified in Section 033053 "Miscellaneous Cast-in-Place Concrete".

3. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

C. Arrange installation of units to provide access space around air-handling units for service and maintenance.

D. Do not operate fan system until filters are in place. At Substantial Completion replace temporary filters used during construction and testing, with new, clean filters.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air-handling unit to allow service and maintenance.

C. Connect condensate drain pans using NPS 1-1/4, ASTM B 88, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

D. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

E. Comply with requirements in Section 233300 "Air Duct Accessories."

3.4 FIELD QUALITY CONTROL

A. A. Manufacturer's Field Service: Engage a factory-authorized service representative, prior to unit startup and again at 30-days after Substantial Completion to inspect, and adjust components, assemblies, and equipment installations including connections.

1. Complete manufacturer’s field assembly, installation and setup checklist.

2. Prepare a written report of findings and recommended corrective actions signed by the factory-authorized service representative. Submit report to Architect along with copies of completed installation and setup checklist.

B. Tests and Inspections:

1. Leak Test: After installation, fill water coils with water, and test coils and connections for leaks.

2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damage and malfunctioning controls and equipment.

C. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

D. Prepare a written report of findings and corrective actions. Submit report to Architect.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify that shipping, blocking, and bracing are removed.

3. Verify that unit is secure on mountings and supporting devices and that the connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.

4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations.

5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.

6. Verify that zone dampers fully open and close for each zone.

7. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.

8. Comb coil fins for parallel orientation.

9. Install new, clean filters for use during startup, testing, balancing and adjusting.

10. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.

2. Measure and record motor electrical values for voltage and amperage.

3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.7 CLEANING

A. After completing system installation, inspect interior and exterior finish. Remove burrs, dirt, and construction debris, and repair damaged finishes inkling chips, scratches and abrasions to restore unit to new condition.

B. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to

remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings

C. Install new, clean filters prior to Substantial Completion.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventive maintenance.

1. Review data in the Operation and Maintenance Manual. Refer to Division 1 Section “Contract Closeout”.

2. Schedule training with Owner through Architect with at least 7 days advance notice.

END OF SECTION 237313

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 238123

COMPUTER-ROOM AIR-CONDITIONERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Floor-mounted computer-room air conditioners, 6 tons and larger.
2. Factory-installed hardware and software to enable the Buildings automation system to monitor and control all available functions.

1.03 DEFINITION

A. BAS: Building automation system.

1.04 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Computer-room air conditioners shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For computer-room air conditioners. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Color Samples: For unit cabinet, discharge grille, and exterior louver and for each color and texture specified.

D. Coordination Drawings: Plans, elevations, and other details, drawn to scale, using input from Installers of the items involved.

E. Seismic Qualification Certificates: For computer-room air conditioners, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Field quality-control reports.

G. Operation and Maintenance Data: For computer-room air conditioners to include in emergency, operation, and maintenance manuals.

H. Warranty: Sample of special warranty.

1.06 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1

D. ASME Compliance: Fabricate and label water-cooled condenser shell to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

1.07 COORDINATION

A. Coordinate layout and installation of computer-room air conditioners and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate installation of computer-room air conditioners with computer-room access flooring Installer.

C. Coordinate sizes and locations of concrete bases with actual equipment provided.

D. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of computer-room air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Humidifiers: Manufacturer's standard, but not less than three years from date of Substantial Completion.
3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set(s) for each belt-driven fan.
2. Filters: One set(s) of filters for each unit.

PART 2 - PRODUCTS

2.01 FLOOR-MOUNTED UNITS 6 TONS AND LARGER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Data Aire Inc.
2. Liebert Corporation.
3. AirFlow
4. Stulz-ATS

B. Description: Packaged, factory assembled, prewired, and prepiped; consisting of cabinet, fans, filters, humidifier, and controls.

C. Cabinet and Frame: Welded steel, braced for rigidity, and supporting compressors and other mechanical equipment and fittings.

1. Doors and Access Panels: Galvanized steel with polyurethane gaskets, hinges, and concealed fastening devices.
2. Insulation: Thermally and acoustically insulate cabinet interior with 1-inch- thick duct liner.
3. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
4. Finish of Exterior Surfaces: Baked-on, textured vinyl enamel; color as selected from manufacturer's standard colors.
5. Floor Stand: Welded tubular steel, high, with adjustable legs and vibration isolation pads.

D. Supply-Air Fan(s):

1. Double-inlet, forward-curved centrifugal fan(s); statically and dynamically balanced.
2. Drive: V-belt, with steel shaft with self-aligning ball bearings and cast-iron or steel sheaves, variable- and adjustable-pitch motor sheave, minimum of two matched belts, with drive rated at a minimum of two times the nameplate rating of motor.

E. Remote, Air-Cooled, Glycol-Solution Cooler: Corrosion-resistant cabinet, copper-tube aluminum-fin coil, multiple direct-drive propeller fans with fan guards, and single-phase motors with internal overload protection and integral electric control panel. Control capacity by cycling fans.

1. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.

F. Glycol-Solution Pump Package: Weatherproof and vented enclosure of enameled, galvanized steel on structural base frame containing centrifugal pump(s) with mechanical seals; electrical-control cabinet with starters, lead-lag switch, automatic switchover, and alarm light.

1. Piping: Interconnecting piping, to and from remote, air-cooled, glycol-solution cooler, with shutoff valves, flow switches, check valves in pump discharge, unions, and pressurized expansion tank with air purge vent and system-charging connection.
2. Glycol: Inhibited ethylene glycol and water solution mixed 50:50, suitable for operating temperature of minus 40 deg F.
3. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.

G. Extended-Surface, Disposable, Panel Filter: Pleated, lofted, nonwoven, reinforced cotton fabric; supported and bonded to welded-wire grid; enclosed in cardboard frame with 2-inch- thick, disposable, glass-fiber prefilter.

H. Infrared Humidifier: High-intensity quartz lamps mounted above stainless-steel evaporator pan, serviceable without disconnecting water, drain, or electrical connections; prepiped and using condensate water from cooling coils with stainless-steel or brass float-valve mechanism; located in bypass airstream; with flush-cycle timer and solenoid drain valve.

I. Integral Electrical Controls: Unit-mounted electrical enclosure with piano-hinged door, grounding lug, combination magnetic starters with overload relays, circuit breakers and cover interlock, and fusible control-circuit transformer.

J. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.

K. Microprocessor-Control System: Continuously monitors operation of process cooling system; continuously displays room temperature and room relative humidity; sounds alarm on system malfunction and simultaneously displays problem. If more than one malfunction occurs, system displays fault in sequence with room temperature and continues to display fault when malfunction is cleared until system is reset.

1. Malfunctions:

a. Power loss.
b. Loss of airflow.
c. Clogged air filter.
d. High room temperature.
e. Low room temperature.

f. High humidity.
g. Low humidity.
h. Smoke/fire.
i. Water under floor.
j. Supply fan overload.
k. Compressor No. 1 - Overload.
l. Compressor No. 1 - Low Pressure.
m. Compressor No. 1 - High Pressure.
n. Compressor No. 2 - Overload.
o. Compressor No. 2 - Low Pressure.
p. Compressor No. 2 - High Pressure.

2. Digital Display:

a. Control power on.
b. Humidifying.
c. Dehumidifying.
d. Compressor No. 1 - Operating.
e. Compressor No. 2 - Operating.
f. Economy cooling.

3. Push buttons shall stop and start process cooling system, silence audible alarm, test indicators, and display room's relative humidity.
4. BAS Interface: Factory-installed hardware and software to enable the Buildings automation system to monitor and control all available functions.

a. Hardwired Points:

1) Monitoring: On-off status, common trouble alarm space temperature space relative humidity.
2) Control: On-off operation, space temperature set-point adjustment space relative humidity set-point adjustment.

b. ASHRAE 135 (BACnet) LonTalk Modbus communication interface with the BAS shall enable the BAS operator to remotely control and monitor the unit from an operator workstation. Control features and monitoring points displayed locally at unit control panel shall be available through the BAS. (Coordinate with BAS)

2.02 FAN MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for hydronic piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where computer-room air conditioners will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install computer-room air conditioners level and plumb, maintaining manufacturer's recommended clearances. Install according to ARI Guideline B.

B. Computer-Room Air-Conditioner Mounting: Install using elastomeric pads. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Minimum Deflection: 1 inch.

C. Remote, Air-Cooled, Glycol-Solution Cooler Mounting: Install using restrained spring isolators. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Minimum Deflection: 1 inch.

D. Glycol-Solution Pump Package Mounting: Install using elastomeric mounts. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Water and Drainage Connections: Comply with applicable requirements in Division 22 Section "Domestic Water Piping." Provide adequate connections for water-cooled units, condensate drain, and humidifier flushing system.

D. Condenser-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Provide shutoff valves in water inlet and outlet piping on water-cooled units.

E. Refrigerant Piping: Comply with applicable requirements in Division 23 Section "Refrigerant Piping." Provide shutoff valves and piping.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
2. After installing computer-room air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Computer-room air conditioners will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

E. After startup service and performance test, change filters and flush humidifier.

3.05 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain computer-room air conditioners.

END OF SECTION

BLANK PAGE

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 238124

COMPUTER-ROOM DX, RACK-COOLING EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Rack-cooling modules with DX compressors.
2. Heat rejection units

1.03 DEFINITIONS

A. COP: Coefficient of performance.

B. EER: Energy efficiency ratio.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include material descriptions, dimensions of individual components and profiles, and finishes for computer-room, rack-cooling equipment.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings: For rack-cooling units and heat rejection units.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

D. Color Samples: For unit cabinets and discharge grille and for each color and texture specified.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, using input from installers of the items involved.

B. Seismic Qualification Certificates: For computer-room rack-cooling equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For computer-room, rack-cooling equipment to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of computer-room, rack-cooling equipment that fails in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. APC by Schneider Electric
   2. Liebert

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Computer-room, rack-cooling equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

   1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ASHRAE Compliance:

   1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
   2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

E. ASME Compliance: Fabricate and label water-cooled condenser shell to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

2.03 COOLING SYSTEM

A. Air-Cooled Refrigerant System

   1. Refrigeration System

      a. Single refrigeration circuit shall include a liquid line filter drier, a refrigerant sight glass with moisture indicator, and adjustable externally equalized expansion valve and a liquid line solenoid valve. The indoor evaporator refrigerant piping shall be spun shut with a nitrogen holding charge. Field relief of Schrader valve shall indicate a leak-free system.

   2. Hydrophilic-Coated Evaporator Coil.

      a. The direct expansion tilted-slab cooling coil shall have 7.25 sq. ft. face area, four or five rows deep. It shall be constructed of copper tubes and hydrophilic coated

aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. Two stainless steel condensate drain pans shall be provided.

3. Compressor

a. The compressor shall be scroll-type with variable capacity operation from 20-100%, commonly known as a Digital Scroll. The compressor solenoid valve shall unload the compressor to provide variable capacity operation. The compressor shall have a suction gas cooled motor, vibration isolators, internal thermal overloads, manual reset high pressure switch, rotalock service valves, low pressure and high pressure transducer, crankcase heater, internal centrifugal oil pump and operating speed of 3500 RPM at 60 Hz. The compressor shall be located outside the airstream and shall be removable and serviceable from the rear of the unit.

4. R410A Refrigerant

a. The system shall be designed for use with R410A refrigerant, which meets the U.S. Clean Air Act for phase-out of HCFC refrigerants.

5. Fan Section

a. The unit shall be equipped with two plug fans: direct driven centrifugal fans with backward curved blades and Electronically Commutated DC motors; commonly referred to as EC plug fans. The fan speed shall be variable and automatically regulated by Liebert iCOM control through all modes of operation. Each fan has a dedicated motor, fault monitoring circuitry and speed controller which provides a level of redundancy. Both impellers shall be made of steel and balanced. The EC plug fans shall be mounted on the rear fan door, the entire fan assembly shall be capable of swinging out of the unit for accessibility. The fans shall be located to blow air through the filters and tilted-slab cooing coil to ensure even air distribution and maximum coil performance.

B. Advance Airflow Management

1. Supply Air Baffle System

a. A field-adjustable, modular supply air baffle system shall be located in the discharge airstream on the front of the cabinet to direct air toward the server racks and balance airflow requirements within the row. The six modular baffle segments shall be easily reconfigurable to redirect airflow as cooling requirements change. Controlling the airflow prevents hot spots and maintains high return air temperatures by not blowing cold air over racks or out the ends of aisles. By focusing the cold air where it is needed and meeting the servers' requirements, the need for excessive airflow and energy consumption is eliminated.

2. Back-Draft Fan Damper

a. When any of the fans are in a non-operational state, due to fan failure or being switched off, a back-draft damper shall automatically close behind each of the fans to prevent the recirculation of air. This ensures that all the air propelled by the fans has passed through the cooling coil. The dampers shall automatically open when fan operation is restored.

2.04 CABINET CONSTRUCTION AND ACCESSIBLIITY

A. Cabinet Construction

1. The exterior panels shall be 20 gauge steel and powder coated with charcoal color paint to protect against corrosion. The double-wall constructed side panels separate the ½ inch, 2.0 lb/cubic feet insulation from the airstream and increase unit rigidity. The units shall be mounted on casters for quick installation and provided with leveling feet. The perforated inlet and outlet panels shall have 81% open area. The rear door shall utilize Knürr rack style handle and hinges to mirror the appearance of neighboring server racks.

B. Serviceability

1. The cabinet shall be designed so all components are easily accessible for service and maintenance through either the front or rear of the unit. Units that are not fully accessible from the front and rear or not serviceable in place are unacceptable.

2. The Superior Service Access Panel shall provide additional access to the top of the system components. Side access is not required.

3. The variable speed EC plug fans shall be mounted on the rear fan door to provide access to all sides when swung out of the unit. Units with a compressor, dual-float condensate pump and canister humidifier shall be conveniently mounted near the edge of the unit.

C. Supply Air Baffle System

1. A field-adjustable, modular supply air baffle system shall be located in the discharge airstream on the front of the cabinet to direct air toward the server racks and balance airflow requirements within the row. The five or six modular baffle segments shall be easily reconfigurable to redirect airflow as cooling requirements change. Controlling the airflow prevents hot spots and maintains high return air temperatures by not blowing cold air over racks or out the ends of aisles. By focusing the cold air where it is needed and meeting the servers' requirements, the need for excessive airflow and energy consumption is eliminated.

2.05 LOCKING DISCONNECT SWITCH

A. A manual disconnect switch shall be mounted in the electrical panel and be capable of disrupting the flow of power to the unit. The electric panel compartment shall be accessible only with the switch in the Off position. It shall be conveniently located behind the display door for quick access.

2.06 SHORT CIRCUIT CURRENT RATING (SCCR)

A. The electrical panel shall provide at least 65,000A SCCR.

2.07 FILTRATION

A. The filter channel shall be an integral part of the system, located within the cabinet and serviceable from the rear. The two filters shall be deep-pleated, 4 inches thick and an ASHRAE 52.2 MERV 8 rating (30% ASHRAE 52.1). A filter clog alarm shall be included. Mesh type, cleanable filters are unacceptable.

B. Extra Filter Set

1. One extra set of filters shall be provided per system.

2.08 STEAM GENERATING CANISTER HUMIDIFIER

A. A canister-type steam generating humidifier shall be factory-installed in the cooling unit and operated by the control system. It is complete with disposable cylinder, all supply and drain valves, steam distributor and electronic controls. The need to change the canister is indicated on the display. The humidifier is designed to operate with water conductivity from 330-670 (60Hz) micros/cm. System shall automatically fill and drain as well as maintain the required water level based on conductivity. An air-gap within the humidifier assembly shall prevent backflow of the humidifier supply water. The humidifier canister shall be removable from the rear of the cabinet.

2.09 CONDENSATE PUMP

A. The dual-float condensate pump shall have a minimum capacity of 6 GPM at 30 ft. head. Pump is complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water conditions.

2.10 LIEBERT iCOM MICROPROCESSOR CONTROL WITH LARGE GRAPHIC DISPLAY

A. The Liebert iCOM unit control shall be factory-set to allow for precise monitoring and control of the IT equipment it is placed near. This control includes"predictive" methods to control air flow and cooling capacity based on Supply and Remote Sensors. Proportional and Tunable PID shall also be user-selectable options. Internal unit components control shall include the following:
   1. Compressor Short Cycle Control – Prevents compressor short-cyucling and needless compressor wear.
   2. System Auto Restart – the auto restart feature shall automatically restart the system after a power failure. Time delay is programmable.
   3. Sequential Load Activation – On initial startup or restart after power failure, each operational load is sequenced with a minimum of one second delay to minimize total inrush current.
   4. Predictive Humidity Control – calculates the moisture content in the room and prevents unnecessary humidification and dehumidification cycles by responding to changes in dew point temperature.

B. The Liebert iCOM control shall be compatible with all Liebert remote monitoring and control devices. Options are available for BMS interface via Modbus, HTTP, BACnet and SNMP.

C. The Liebert iCOM control processor shall be microprocessor-based with a 320x240 dot matrix graphic front monitor display and control keys for user inputs mounted in an ergonomic, aesthetic housing. The display and housing shall be viewable while the front panel is open or closed. The controls shall be menu driven. The display shall be organized into three main sections: User Menus, Service Menus and Advanced Menus with a secure login for each section. The system shall display user menus for active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operations status in % of each function, date and time), total run hours, various sensors, display setup and service contacts. A password shall be required to make system changes within the service menus. Service menus shall include setpoints, shall be required to make system changes within the service menus, Service menus

shall include setpoints, standby settings (lead/lag), timer/sleep mode, alarm setup, sensor calibration, maintenance/wellness settings, options setup, system/network setup, auxiliary boards and diagnostics/service mode. A password shall be required to access the advanced menus, which include the factory settings and password menus.

D. User Menus Shall be Defined as:
1. Active Alarms: Unit memory shall hold the 200 most recent alarms with time and date stamp for each alarms.
2. Event Log: Unit memory shall hold the 400 most recent events with ID number, time and date stamp for each event.
3. Graphic Data View: Two selectable graphic records shall be available from the following: return air temperature, return air humidity, dew point, and supply air temperature.
4. Unit View – Status Overview: Simple or Graphical Unit View summary displays shall include temperature and humidity values, active functions (and percent of operation) and any alarms of the host unit.
5. Total Run Hours: Menu shall display accumulative component operating hours for major components including compressors, Econ-O-coil (FC), fan motor, humidifier and reheat.
6. Various Sensors: Menu shall allow setup and display of optional custom sensors.
7. Display Language: Customer shall be able to select the desired language at the time of the order from the following choices: (English, French, Italian, Spanish, German)
8. Service Contacts: Menu shall allow display of local service contact name and phone number.
9. System View – Status Overview: “System view” shall display a summary of operation for the total number of operating units within a Unit-to Unit (U2U) configuration.
10. Spare Parts List: Menu shall include a list of critical spare parts, their quantity and part numbers.
11. Unit Diary: Menu shall include a free field area within the unit memory where unit history may be stored for reference.

E. The Service Menus Shall be Defined as:
1. Setpoints: Menu shall allow setpoints within the following ranges:
   a. Temperature Setpoint 41-104°F*
   b. Temperature Proportional Band: +1-50°F
   c. Fan Temperature Setpoint: 41-104°F.
   d. Humidity Setpoint: 20-80% RH*
   e. Humidity Sensitivity: 1-30% RH
   f. High Temperature Alarm: 35-90°F
   g. Low Temperature Alarm: 35-90°F
   h. High Humidity Alarm: 15-85% RH
   i. Low Humidity Alarm: 15-85% RH

   *The microprocessor may be set within these ranges; however, the unit may not be able to control to extreme combinations of temperature and humidity.

F. Standby Settings/Lead-Lag: Menu shall allow planned rotation or emergency rotation of operating and standby units.

G. Alarm Setup: Menu shall allow customer settings for alarm notification (audible/local/remote) The following alarms shall be available:
1. High Temperature
2. Low Temperature
3. High Humidity

4. Low Humidity
5. Compressor Overload
6. Main Fan Overload
7. Humidifier Problem
8. High Head Pressure
9. Change Filter
10. Fan Failure
11. Low Suction Pressure
12. Unit Off

H. Audible Alarm: The audible alarm shall annunciate any alarm that is enabled by the operator.

I. Common alarm: a programmable common alarm shall be provided to interface user-selected alarms with a remote alarm device.

J. Remote Monitoring: All alarms shall be communicated to the Lievert monitoring system siwth the following information: date and time of occurrence, unit number and present temperature and humidity.

K. Sensor Calibration: Menu shall allow unit sensors to be calibrated with external sensors.

L. Maintenance/Wellness Settings: Menu shall allow reporting of potential component problems before they occur.

M. Options Setup: Menu shall provide operation settings for the installed components.

N. System/Network Setup: Menu shall allow Unit-to Unit (U2U) communication and setup for Teamwork modes of operations (up to 32 units).

O. Teamwork Modes of Operation: Saves energy by preventing operation of units in opposite modes multiple units.

P. Diagnostics/Service Mode: The Liebert iCOM control shall be provided with self-diagnostic to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as on or off at the front display. Control outputs shall be able to be turned on or off from the front display without using jumpers or a serviced terminal. An LED on a circuit board will indicate each control output.

Q. Advance Menus

1. Factory Settings: Configuration settings shall be factory-set based on the pre-defined component operation.
2. Change Passwords: Menu shall allow new passwords to be set or changed.
3. Liebert iCOM Wall Mount Large Graphic Display vNSA Panel. The Liebert iCOM Large Graphic Display Kit shall include an ergonomic, aesthetically pleasing housing, a 320x240 dot matrix graphic display and a 120V power supply. The Wall Mount Large Graphic Display shall be used to allow remote location of a system view display and all features of Large Graphic User, Service and Advance menus for use with Liebert iCOM controller products connected for Unit-to-Unit (U2U) communications.
4. Liebert iCOM Control Methods and Options

a. Controlling Sensor Options: Liebert iCOM is flexible in the sense that it allows for controlling the capacity and fan from multiple different sensor selections and they are as follows:
   1) Cooling Capacity
      a) Supply
      b) Remote
      c) Return
   2) Fan Speed
      a) Supply
      b) Remote
      c) Return
      d) Manual (for diagnostic or to receive a signal from the BMS through the ID-UNITY-DP card)

5. Teamwork Modes of Operation: Liebert iCOM teamwork saves energy by preventing operation of units in opposite modes multiple units. There are currently 3 modes of teamwork operation, they are as follows:
   a. Teamwork Mode 1: This operation allows the control to optimize a group of connected iCOM units using the U2U. The capacity and fan operations in coupled together in this mode.
   b. Teamwork Mode 2: This operation allows the control to optimize a group of connected Liebert iCOM units using the U2U. The capacity and fan operations in decoupled in this mode, meaning the fan and cooling ramp and respond to the thermal load based on its controlling sensors.
   c. Optimized Aisle – Teamwork Mode 3: This operation allows the control to optimize a group of connected iCOM units using the U2U. The capacity and fan operations in decoupled in this mode, meaning the fan and cooling ramp and respond to the thermal load based on its controlling sensors. When using Optimized Aisle the fans can be controlled by using static pressure (DP or static) with a secondary remote temperature sensor as an override to ensure the inlet rack temperature is being met.

6. Temperature Compensation: Liebert iCOM allows ability to compensate the supply and return set points to maintain cooling OR return temperatures to meet cooling needs or SLA guidelines.

7. Dew Point Control: Liebert iCOM has the ability to control the humidity based on dew point to ensure accurate humidity control. This will eliminate needs to dehumidify or humidify based on air temperature with looking a moisture content.

8. Virtual Back-Draft Damper: Liebert iCOM allows for the use of a virtual back-draft damper – eliminating the need for a mechanical damper. This allows the fans to spin at a low speed (15%) to act as a damper. NOTE: EC fan are needed for this control.

9. Cascade: Liebert iCOM cascade option allows the units to turn ON and OFF based on IT load when in teamwork mode 1. When utilizing Optimized Aisle, teamwork mode 3, the cascading becomes more dynamic as the units coordinate the fan speed to save energy and to meet the cooling demands. For instance, with a iCOM group of 6 units and only 50% of the IT capacity the iCOM will only operate 4 units at 80% fan speed and leave the other 2 units in standby/cascade. As the load increases and more IT equipment is and more IT equipment is added to the data center the Liebert iCOM will automatically respond to the new load and bring on the 5 unit increasing the units in operation to 5. As the load shifts up or down based on load, capacity and server utilization the control shall meet the needs by cascading unit ON or putting them back into standby.

10. Virtual Master: As part of the robust architecture of the Liebert iCOM control it allows for virtual master that coordinates operation. If for any reason the virtual master was to become disconnected to the control will shift responsibility to the next unit in the group.

11. Remote 2T Sensor Sharing: Each Liebert CRV unit can have 10-2T sensors connected and used as a controlling sensor. As part of the U2U network and teamwork those sensors can be shared and used to control the units and provide greater flexibility, visibility and control using that to respond to changes in the data center. Those sensors can be as a minimum, maximum or average temperature to control.

12. Quick Start: Each Liebert CRV unit be equipped with a quick start feature that allows the unit to quickly recover from a loss of power.

13. Global Condenser: Direct Expansion Liebert CRV's can be matched to a premium global condenser device that will provide an intelligent communication link. This enables enhanced monitoring and alarming, diagnostics insight, nighttime low noise mode and fan reversal for cleaning mode.

2.11 RACK TEMPERATURE SENSORS

A. The Liebert CRV shall be provided with three 2T rack temperature sensors, which consist of a vented case with two temperature probes. The sensors shall provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow provided. The sensor data shall be available to remote BMS and monitoring systems. The network shall consist of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor.

2.12 LIEBERT vNSA

A. The Liebert vNSA network switch is designed for connecting multiple Ethernet-ready devices. The unit shall have one or two 8-port switches, providing a total of 8 or 16 Ethernet ports. The Liebert vNSA shall have 100-240VAC shingle phase for proper operation. A universal power supply (12V, 1.5A) is installed inside a steel ensure secured with a key lock, with a hard-wired connection for 120V or 230V operation. A Liebert iCOM display shall be mounted on the front. Liebert iCOM shall permit interconnecting Liebert CRV unit to communicate through the use two CAT5 or better network patch cables with RJ45 connectors to connect devices to available ports.

B. The number of ports available for Ethernet-ready devices varies by the number of 8-port switches included. The Liebert iCOM display use one port for connections to the Liebert iCOM display. The 16-port model uses two ports to interconnect the switches.

Model	# Ports	To Liebert iCOM Display	Upper & Lower Switches	3 Ports Available	Maximum Liebert CRV's that may be connected
vNSA8-iCOM-DR	8	1	N/A	7	3 Units
vNSA 16-iCOM-CR	16	1	2	13	6 Units

2.13 COMMUNICATION INTERFACES

A. Remote Shutdown Terminal
1. The remote shutdown terminal shall provide the owner with a location to remotely shut down the unit complying with the National Fire Code.

B. Common Alarm Contact
1. The common alarm contact shall provide the customer with a set of normally open (n/o) contacts for remote indication of unit alarms.

C. Liebert IntelliSlot Unity-DP Card
1. The Liebert IntelliSlot Unity Card (IS-UNITY-DP) shall provide ground fault isolated RS-485 Modbus, BACnet IP and Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, it shall provide ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network Management Systems, HTTP for Web page viewing, SMTP for e-mail and SMS for mobile messaging. The card shall support IP and 485 protocols simultaneous.

D. Liebert Liqui-tect 410 Point Leak Detection Sensor for Remote Mounting
1. A total of one solid-state water sensor per unit with no moving parts and hermetically sealed to keep out dust and dirt shall be provided. The Liebert Liqui-tect 410 (LT410) shall provide a single-point detection of leaks. The point detection sensor shall have two gold-plated sensing probes to prevent corrosion resistance and to provide accurate readings. The LT410 shall constantly monitor points for leaks, internal faults and power failures and warn of any abnormal conditions. Mounting brackets shall allow for sensor height adjustment and leveling. The LT410 shall provide tow independent outputs to signal both a local alarm panel and a remote building management system or external equipment. The LT410 shall be rated for 24VAC, 50/60HZ and 0.10 amp.

E. Liebert Liqui-tect 460 Module
1. The LT460 shall consist of a metal enclosure with a hinged top door providing access to the internal circuit board for wiring termination and configuration of DIP switches. The LT460 shall monitor up to 100 feet of connected LT500Y leak detection cable.

F. LT500Y Leak Detection Cable

1. The cable material and construction shall allow the cable to lie flat when used with hold-down clips. The LT500Y shall be plenum-rated and UL-listed for safe operation. Cables shall be available in lengths of 20, 25, 30, 35, and 45 feet.
2. The LT460 shall be rated for 24 VAC, 50/60Hz and 0.12A.

2.14 HEAT REJECTION

A. Air-Cooled Condenser
1. The Emerson-manufactured outdoor air-cooled condenser shall be the low profile, multiple direct drive, propeller fan type. The condenser shall be constructed of aluminum and contain a copper tube, aluminum fin coil arranged for vertical air discharge.

B. Variable Frequency Drive Control
1. The winter control system for the air-cooled condenser shall be Liebert VFD control. The control system shall include a variable frequency drive, inverter duty fan motor operating from 0% to 100% motor RPM based on head pressure, refrigerant pressure transducers, ambient-temperature thermostat(s), motor overload protection and electrical control circuit, factory-wired in the control panel. VFD control shall be furnished on the fan adjacent to the connection end of the condenser, which runs continuously with the compressors. The variable speed fan motor shall be an inverter duty motor with permanently lubricated ceramic bearings. The Liebert variable frequency drive control system shall provide overload protection for the variable speed motor.
2. Each ambient-temperature-controlled On/Off fan motor shall have built-in overload protection. The transducer shall automatically sense the highest head pressure of either operating compressor and control the variable speed fan on the air-cooled condenser to properly maintain the head pressure. Transient Voltage surge Suppression and locking disconnect is standard and shall be factory-installed and wired in the enclosed condenser electrical panel section. The VFD control system shall provide positive startup and operation in ambient temperatures as low as -20°F.

C. Liebert Lee-Temp System
1. The winter control system for the air-cooled condenser shall be Liebert Lee-Temp. The Liebert Lee-Temp system shall allow startup and positive head pressure control with ambient temperatures as low as -30°F. The Liebert Lee-Temp package shall include the following components for each refrigeration circuit: Insulated receiver, pressure relief valve, head pressure three-way control valve and rotalock valve for isolating the refrigerant charge. The Liebert Lee-Temp receiver shall be factory-insulated and mounted ready for the field connection to the air-cooled condenser. A disconnect switch shall be factory-mounted and wired to the condenser control panel, accessible from the exterior. The Liebert Lee-Temp (150)(300) Watt heater shall require a separate power supply of (120) (230) volt, single phase.

2.15 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load does not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for refrigeration piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install precision cooling units in accordance with manufacturer’s installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer’s recommended clearances.

B. Layout and install computer-room rack-cooling equipment and suspension system coordinated with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

C. Install computer-room, rack-cooling equipment level and plumb, maintaining manufacturer's recommended clearances. Install according to AHRI Guideline B.

D. Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer’s electrical connection diagram submittal to electrical contractor.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other heating, ventilating, and air-conditioning Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install and connect devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer’s piping connection diagram submittal to mechanical/piping contractor.

C. Where installing piping adjacent to computer-room rack-cooling equipment, allow space for service and maintenance.

D. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Provide shutoff valves and piping.

E. Connect water supply and drains to air conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes required.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
2. Start up mainframe coolant units in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements
3. Start up cooling units in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements.
4. After installing computer-room rack-cooling equipment and after electrical circuitry has been energized, test for compliance with requirements.
5. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
6. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Computer-room, rack-cooling equipment will be considered defective if it does not pass tests and inspections.

D. Start up environmental control units in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements.

E. Prepare test and inspection reports.

3.05 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain computer-room, rack-cooling equipment.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 238216

HYDRONIC AIR COILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes hydronic heating and cooling air coils.

B. VAV box and Phoenix(JCI) valve reheat coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil.

2. Include rated capacities, operating characteristics, and pressure drops for each air coil.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which coil location and ceiling-mounted access panels are shown and coordinated with each other.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. ASHRAE Compliance: Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

2.2 COILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aerofin.
2. Carrier Corporation; a UTC company.
3. Coil Company, LLC.
4. Colmac Coil Manufacturing, Inc.
5. Dunham-Bush USA.
6. Heatcraft Worldwide Refrigeration.
7. Greenheck Fan Corporation.
8. Trane.
9. USA Coil & Air.
10. York

B. Performance Ratings: Tested and rated according to AHRI 410 and ASHRAE 33.

C. Minimum Working-Pressure/Temperature Ratings: 200 psig, 325 deg F.

D. Source Quality Control: Factory tested to 300 psig.

E. Tubes: ASTM B 743 copper, minimum 0.035 inch thick.

F. Fins: Aluminum or Copper, minimum 0.006 inch thick.

G. Headers: Seamless copper tube with brazed joints, prime coated.

H. Reference specification 233600 “Air Terminal Units” for reheat coils for both VAV Boxes and Phoenix valves.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Straighten bent fins on air coils.

D. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to coils to allow service and maintenance.

C. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Section 230900 "Instrumentation and Control for HVAC," and other piping specialties are specified in Section 232116 "Hydronic Piping Specialties."

END OF SECTION 238216

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 238239

CABINET UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cabinet unit heaters with centrifugal fans and hot-water coils.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CWP: Cold working pressure.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings:

1. Include plans, elevations, sections, and details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include location and size of each field connection.

4. Include details of anchorages and attachments to structure and to supported equipment.

5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.

6. Indicate location and arrangement of piping valves and specialties.

7. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.

2. Structural members to which cabinet unit heaters will be attached.

3. Method of attaching hangers to building structure.

4. Size and location of initial access modules for acoustical tile.

5. Items penetrating finished ceiling, including the following:

a. Lighting fixtures.

b. Air outlets and inlets.

c. Speakers.

d. Sprinklers.

e. Access panels.

6. Perimeter moldings for exposed or partially exposed cabinets.

B. Seismic Qualification Certificates: Submit certification that cabinet unit heaters, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Include detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cabinet Unit-Heater Filters: Furnish one spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airtherm.

2. Dunham-Bush.

3. McQuay International; Daikin Industries.

4. Modine Mfg. Co.

5. Ted Reed Thermal, Inc.

6. Trane.

7. Young Radiator Co.

2.2 DESCRIPTION

A. Factory-assembled and -tested unit complying with AHRI 440.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 PERFORMANCE REQUIREMENTS

A. (LEED) ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. (LEED) ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

C. Seismic Performance: Cabinet unit heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.4 COIL SECTION INSULATION

A. Insulation Materials: ASTM C 1071; surfaces exposed to airstream shall have aluminum-foil facing to prevent erosion of glass fibers.

1. Thickness:

a. 1/2 inch .

2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.

3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

4. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.

5. (LEED) Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.5 CABINETS

A. Material: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect.

1. Vertical Unit, Exposed Front Panels: Removable panels with channel-formed edges secured with tamperproof cam fasteners.

   a. Minimum thickness: 15GA-0.0673-inch- sheet steel.

2. Horizontal Unit, Exposed Bottom Panels: Removable panels secured with tamperproof cam fasteners and safety chain.

   a. Minimum thickness: 15GA-0.0673-inch- sheet steel.

3. Recessed Flanges: Steel, finished to match cabinet.

4. Control Access Door: Key operated.

5. Base: Minimum 0.0528-inch- thick steel, finished to match cabinet:

   a. 6 inches high with leveling bolts.

6. Extended Piping Compartment: 8-inch- wide piping end pocket.

7. False Back: Minimum 0.0428-inch- thick steel, finished to match cabinet.

8. Outdoor-Air Wall Box: Minimum 0.1265-inch- thick, aluminum, rain-resistant louver and box with integral eliminators and bird screen; aluminum louver with baked-enamel finish in color selected by Architect from manufacturer's standard colors.

   a. Outdoor-Air Damper: Galvanized-steel blades with edge and end seals and nylon bearings; with;

      1) (LEED) electronic, two-position actuators.

2.6 FILTERS

A. Minimum Arrestance: According to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Pleated: 90 percent arrestance and MERV 7.

2.7 COILS

A. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.

2.8 CONTROLS

A. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.

2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

B. Factory, Hot-Water Piping Package: ASTM B 88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

1. Provide equipment for one of the following operated valve arrangements:

a. Calibrated-Orifice Balancing Valves: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature; with calibrated orifice or venture, connection for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.

2. Control valve:

a. Two-way, modulating control valve.

3. Hose Kits: Minimum 400-psig working pressure, and operating temperatures from 33 to 211 deg F. Tag hose kits to equipment designations.

a. Length: 24 inches.

b. Minimum Diameter: Equal to cabinet unit-heater connection size.

4. Two-Piece, Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

5. Y-Pattern, Hot-Water Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig minimum working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 threaded pipe and full-port ball valve in strainer drain connection.

6. Wrought-Copper Unions: ASME B16.22.

C. Control devices and operational sequences are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence of Operations for HVAC Controls."

D. Basic Unit Controls:

1. Control voltage transformer.

2. Thermostat with the following features:

a. Wall-mounted.

b. Heat-off switch.

c. Fan on-auto switch.

d. Adjustable deadband.

e. Set point:

1) Concealed.

f. Indication:

1) Concealed.

2) Deg F.

3. Temperature sensor:

a. Wall-mounted.

4. Unoccupied period override push button.

5. Data entry and access port.

a. Input data includes room temperature and occupied and unoccupied periods.

b. Output data includes room temperature, supply-air temperature, entering-water temperature, operating mode, and status.

E. DDC Terminal Controller:

1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.

2. Unoccupied Period Override: Two hours.

3. Unit Supply-Air Fan Operations:

a. Occupied Periods: Fan runs continuously.

b. Unoccupied Periods: Fan cycles to maintain setback room temperature.

4. Heating-Coil Operations:

a. Occupied Periods: Provide heating if room temperature falls below thermostat set point via:

1) Open control valve.

b. Unoccupied Periods: If room temperature falls below setback temperature;

1) Start fan and open control valve.

5. (LEED) Outdoor-Air Damper Operation:

a. Occupied Periods: Open dampers. Delay damper opening if room temperature is more than three degrees below set point.

b. Unoccupied Periods: Close damper.

6. Controller shall have volatile-memory backup.

F. BAS Interface Requirements:

1. Interface relay for scheduled operation.

2. Interface relay to provide indication of fault at central workstation.

3. Interface shall be BAC-net compatible for central BAS workstation and include the following functions:

a. Adjust set points.

b. Cabinet unit-heater start, stop, and operating status.

c. Data inquiry, including supply-air and room-air temperature.

d. Occupied and unoccupied schedules.

G. Electrical Connection: Factory-wired motors and controls for a single field connection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."

B. Install cabinet unit heaters to comply with NFPA 90A.

C. Suspend cabinet unit heaters from structure with elastomeric hangers and seismic restraints. Vibration isolators and seismic restraints are specified in Division 23 "Vibration and Seismic Controls for HVAC."

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

E. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 23 "Hydronic Piping," Division 23 Hydronic Piping Specialties," Division 23 "Steam and Condensate Heating Piping," and Division

23 Steam and Condensate Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

D. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Division 23 "Air Duct Accessories."

E. Comply with safety requirements in UL 1995.

F. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of cabinet unit heater. Hydronic specialties are specified in Division 23 "Hydronic Piping" and Division 23 Hydronic Piping Specialties."

G. Unless otherwise indicated, install union and gate or ball valve on steam-supply connection and union, strainer, steam trap, and gate or ball valve on condensate-return connection of cabinet unit heater. Steam specialties are specified in Division 23 Steam and Condensate Piping Specialties."

H. Ground equipment according to Division 23 "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 23 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Operate electric heating elements through each stage to verify proper operation and electrical connections.

3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

END OF SECTION 238239

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 238240

PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes propeller unit heaters with hot-water coils.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CWP: Cold working pressure.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings:

1. Include plans, elevations, sections, and details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include location and size of each field connection.

4. Include details of anchorages and attachments to structure and to supported equipment.

5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.

6. Indicate location and arrangement of piping valves and specialties.

7. Indicate location and arrangement of integral controls.

8. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.

2. Structural members to which propeller unit heaters will be attached.

3. Method of attaching hangers to building structure.

4. Size and location of initial access modules for acoustical tile.

5. Items penetrating finished ceiling, including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.

B. Seismic Qualification Certificates: Submit certification that propeller unit heaters, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Include detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airtherm.
2. Buffalo Forge Co.
3. Dunham-Bush Inc.
4. McQuay International; Daikin Industries.
5. Modine Mfg. Co.
6. Ted Reed Thermal, Inc.
7. Trane.
8. Wing (The) Co.
9. Young Radiator Co.
10. Reznor
11. Zehnder

2.2 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in vertical and horizontal discharge configuration with adjustable discharge louvers.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 PERFORMANCE REQUIREMENTS

A. (LEED) ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. (LEED) ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

C. Seismic Performance: Propeller unit heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. (LEED) Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.5 COILS

A. General Coil Requirements: Test and rate propeller unit-heater coils according to ASHRAE 33 in the following application:

1. Hot-water.

B. Hot-Water Coil: Copper tube, minimum 0.025-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 325 deg F, with manual air vent. Test for leaks to 350 psig underwater.

2.6 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated, multispeed. Comply with requirements in Division 23 "Common Motor Requirements for HVAC Equipment."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers. Hanger rods and attachments to structure are specified in Division 23 "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 23 "Vibration Controls for HVAC."

D. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers with vertical-limit stop. Hanger rods and attachments to structure are specified in Division 23 "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 23 "Vibration and Seismic Controls for HVAC."

E. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 23 "Hydronic Piping," Section 232116 Hydronic Piping Specialties," Division 23 "Steam and Condensate Heating Piping," and Division 23 “Steam and Condensate Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to propeller unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

D. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of propeller unit heater. Hydronic specialties are specified in Division 23 "Hydronic Piping" and Division 23 Hydronic Piping Specialties."

E. Unless otherwise indicated, install union and gate or ball valve on steam-supply connection and union, strainer, steam trap, and gate or ball valve on condensate-return connection of propeller unit heater. Steam specialties are specified in Division 23 Steam and Condensate Piping Specialties."

F. Ground equipment according to Division 26 "Grounding and Bonding for Electrical Systems."

G. Connect wiring according to Division 26 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Operate electric heating elements through each stage to verify proper operation and electrical connections.

3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

END OF SECTION 238240

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 238414

HUMIDIFIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following humidifiers:

1. Steam injection.

1.3 DEFINITION

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, manifolds, and attachments to other work.

1. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Detail humidifiers and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which humidifiers will be attached.

2. Size and location of initial access modules for acoustical tile.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For humidifiers to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Supply one replacement electrode cylinder with each self-contained humidifier.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ARI 640, "Commercial and Industrial Humidifiers."

1.9 COORDINATION

A. Coordinate location and installation of humidifiers with manifolds in ducts and air-handling units or occupied space. Revise locations and elevations to suit field conditions and to ensure proper humidifier operation.

PART 2 - PRODUCTS

2.1 STEAM-INJECTION HUMIDIFIERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong International
2. Carel USA, LLC
3. DRI-STEEM Humidifier Co.
4. Herrmidifier
5. Hygromatik; Sprax Sarco
6. Nortec Industries Inc.
7. Pure Humidifier Co.

B. Manifold: ASTM A 666, Type 304 stainless steel; insulated with 1/2-inch fiberglass and stainless-steel jacket; and]extending the full width of duct or plenum with mounting brackets at ends.

C. Discharge Nozzle and Dispersion Fan:

1. Steam-jacketed discharge nozzle, aluminum blade propeller fan with finger guard, and single-speed motor interlocked to operate with humidifier.

2. Fan Mounting: Above and behind discharge outlet on bracket integral to discharge outlet.

D. Steam Separator: ASTM A 666, Type 304 stainless steel with separate humidifier control valve.

E. Humidifier Control Valve:

1. Actuator: Electric modulating with spring return.

F. Steam Trap: Inverted-bucket type, sized for a minimum of 3 times the maximum rated condensate flow of humidifier at 1/2-psig inlet pressure.

G. Accessories:

1. Return-duct-mounting humidistat.
2. Duct-mounting, high-limit humidistat.
3. Aquastat mounted on steam condensate return piping to prevent cold operation of humidifier.
4. In-line strainer.
5. Airflow switch for preventing humidifier operation without airflow.

H. Capacities and Characteristics: See schedule on drawings

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, air-handling units, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before humidifier installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install humidifiers with required clearance for service and maintenance. Maintain path, downstream from humidifiers, clear of obstructions as required by ASHRAE 62.1.

B. Seal humidifier manifold duct or plenum penetrations with flange.

C. Install humidifier manifolds in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

D. Install stainless-steel drain pan under each manifold mounted in duct.

1. Construct drain pans with connection for drain; insulated[and complying with ASHRAE 62.1].

2. Connect to condensate trap and drainage piping.

3. Extend drain pan upstream and downstream from manifold a minimum distance recommended by manufacturer but not less than required by ASHRAE 62.1.

E. Install manifold supply piping pitched to drain condensate back to humidifier.

F. Install drip leg upstream from steam trap a minimum of 12 inches tall for proper operation of trap.

G. Equipment Mounting:

1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Install piping adjacent to humidifiers to allow service and maintenance.

2. Install shutoff valve, strainer, backflow preventer, and union in humidifier makeup line.

B. Install electrical devices and piping specialties furnished by manufacturer but not factory mounted.

C. Install piping from safety relief valves to nearest floor drain.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain humidifiers. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 238414

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260533 “Raceways and Boxes for Electrical Systems”
2. Section 260923 “Lighting Control Devices”
3. Section 260936 “Standalone Modular Preset Dimming Controls”
4. Section 260943 “Relay-Based Lighting Controls”
5. Section 274133 “Master Antenna Television System”
6. Section 275117 “Networked Public Address and Paging System”
7. Section 275119 “Sound Masking Systems”
8. Section 281300 “Access Control”
9. Section 283111 “Digital, Addressable Fire-Alarm System”
10. Section 270000 "Intermountain Healthcare Networked Structured Cable & Standards" for cabling used for voice and data circuits.

1.3 DEFINITIONS

A. Outlet Box: Electrical box used to support utilization equipment such as a receptacle or light fixture.

B. Pull Box: Electrical box through which branch circuit or feeder conductors are run but are not spliced.

C. Junction Box: Electrical box used for splicing branch circuit or feeder conductors.

D. Multiwire Branch Circuit: A branch circuit as defined by the National Electrical Code that shares a grounded conductor between two of more phase conductors.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SINGLE CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Alpha Wire Company.
2. Belden Inc.
3. Cerro Wire LLC.
4. Encore Wire Corporation.
5. General Cable; General Cable Corporation.
6. Southwire Company.
7. Thomas & Betts Corporation; A Member of the ABB Group.

B. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.

2.2 ISOLATED POWER SYSTEM CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Alpha Wire Company.
2. Belden Inc.
3. Cerro Wire LLC.
4. Encore Wire Corporation.
5. General Cable; General Cable Corporation.
6. Southwire Company.
7. Thomas & Betts Corporation; A Member of the ABB Group.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Type XHHW wire with crosslinked polyethylene insulation and a dielectric constant of 3.5 or less shall be used for all branch circuit wiring.

2.3 MULTI-CONDUCTOR CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Southwire Company.
2. AFC Cable Systems.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.

D. Multi-conductor Cable, Type AC-HCF:

1. Armor: Galvanized Interlocking Steel Strip (green striped or solid green).
2. Conductors: Solid Copper
3. Conductor Insulation: THHN-2 with individual moisture resistant, fire retardant paper wrap on each individual conductor.
4. Grounding: 16 AWG integral bond wire and insulated green copper grounding conductor.

5. Neutral (Grounded) Conductor: White for 120Y/208 volt systems and Grey 480Y/277 volt systems.
6. Maximum Voltage Rating: 600 volts.
7. References and Ratings:
    a. UL 4, 83, 1479, 1581, 2556, File Reference E7330
    b. NEC 250.118(8), 300.22(C), 392, 320, 517.13, 518, 645
    c. Federal Specification A-A–59544 (formerly J-C–30B)
    d. UL Classified 1, 2, and 3-hour through (Fire) penetration product, R–14141
    e. Environmental Air-Handling Space Installation per NEC 300.22(C)

E. Other Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Type SO with ground wire.

2.4 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    1. 3M.
    2. AFC Cable Systems; a part of Atkore International.
    3. Hubbell Power Systems, Inc.
    4. Ideal Industries, Inc.
    5. ILSCO.
    6. O-Z/Gedney; a brand of Emerson Industrial Automation.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.5 CORD REELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    1. APC Group; Kitchen Leash

B. Case (housing):
    1. Dimensions: 9” x 12” x 3’
    2. Material: Molded Polypropylene 3.175 mm thickness
    3. 94v-2 flammability rating

C. Power Cord
    1. Conductors: 14/3 AWG copper type SJOW
    2. Length: 10 feet
    3. Rating: 200 degrees F

D. Receptacle/Plug
    1. Rated: 125vac/20 amp
    2. Receptacle: NEMA 5-15P
    3. Plug: Dual Duplex rated 20 amp

E. Mounting Bracket: Designed for installation on the ceiling type where the cord reel will be installed.

2.6 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

2.7 FIRE-ALARM WIRE AND CABLE

A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 14 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 4 AWG; for feeders No. 4 AWG and larger provide copper feeders unless aluminum is specifically indicated on the one-line diagrams. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Aluminum conductors may not be installed for circuiting to imaging and mechanical equipment.

B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Refer to Section 260533 “Raceways and Boxes for Electrical Systems” for raceway types and applications.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders below Slabs-On-Grade, and Underground: Type THWN-2, single conductors in raceway.

E. Multiwire Circuits: may not be used for branch circuit wiring. All 120 volt and 277 volt circuits shall be provided with a dedicated grounded conductor (neutral) for each phase conductor. Up to three of these circuits may be installed in a single conduit but not more than one conductor of each phase may be installed in a single conduit.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

1. Armored cable, Type AC-HCF may be installed for normal and equipment system single branch circuits concealed in walls, and partitions in lengths between outlet boxes 30' or less and not as homeruns or wiring between pullboxes or junction boxes.
2. Armored cable, Type AC-HCF may be installed between the first outlet box concealed in a wall or partition and a junction box above an accessible ceiling immediately above the location where the cable exits the wall or partition framing.

G. Branch Circuits below Slabs-on-Grade and Underground: Type THHN/THWN-2, single conductors in raceway. Installation of raceways within any concrete slab or composite concrete and steel deck is prohibited. NEC 517.13 (A) requires that all branch circuits serving patient care areas are provided with an effective ground-fault current path by installation in a metal raceway system, or a cable having a metallic armor or sheath assembly that qualifies as an equipment grounding conductor. Metallic raceways are not a specified raceway for branch circuits installed below slabs-on-grade. To assure compliance with the NEC requirement, both initially and when remodels occur in the future, the installation of branch circuit wiring under slabs-on-grade is limited to circuits supplying only the following rooms and area types without extension beyond the room or area to a room or area not listed here:

1. Mechanical Spaces.
2. Electrical Rooms.
3. Food Service.

H. Branch circuit wiring may also be installed under slabs-on-grade to supply power for the following:

1. Systems Furniture.
2. Floor Boxes.
3. Direct wired equipment that is not located against a wall.

I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain-relief device at terminations to suit application.

J. Isolated Power System Conductors: #10 AWG, Type XHHW-2 stranded with cross-linked PE insulation and a dielectric constant of 3.5 or less, installed in EMT conduit. To limit leakage-current the branch circuit conductors must be reduced to the shortest overall length possible. Install conduits for Isolated Power System branch circuits in the most direct path between the panel and the outlet box, which is not necessarily parallel and perpendicular to the structure and framing, to reduce conductor length. Install only one circuit in per conduit. Do not use pulling compounds when installing the branch circuit conductors of Isolated Power Systems.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Do not use pulling compounds or lubricant for installation of branch circuit conductors for Isolated Power Systems.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CORD REELS

A. Coordinate location of cord reels to align with kitchen equipment supplied by the cord reel.

B. Fasten brackets to structure using minimum 3/8” threaded rod and to rigidly support the cord real. Minimum of 2 rods per bracket with addition if required to provide a rigid support.

C. Adjust cord stopper as coordinated with owner.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

D. Comply with requirements in Section 283111 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with panel and circuit number and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.

a. Imaging Equipment

2. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger.

Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 260523

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Application

1. This specification section covers provision and installation of control and low-voltage electrical power cables including cables associated with building automatic systems (BAS), low voltage lighting controls, mechanical systems control cables, and all similar control and low-voltage cabling utilized for control of devices and equipment not associated with data and telecommunications systems which are covered by Division 27 and fire alarm, security, and specialty systems which are covered by Division 28. However, comply with the requirements of Division 27 where related to non-data and telecommunications cabling.

B. Section Includes:

1. Category 5e balanced twisted pair cable.
2. Category 6 balanced twisted pair cable.
3. Category 6a balanced twisted pair cable.
4. RS-485 cable.
5. Control cable.
6. Control-circuit conductors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CABLING

A. Provide style and type of cabling as specified herein or as otherwise directed by the manufacturer of the equipment bring controlled or controlling devices and/or relevant specification section for the respective equipment.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

1. Flame Travel Distance: 60 inch (1520 mm) or less.
2. Peak Optical Smoke Density: 0.5 or less.
3. Average Optical Smoke Density: 0.15 or less.

C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inch (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."

B. Painting: Paint plywood on all sides and edges with flat white latex paint. Comply with requirements in Section 099123 "Interior Painting."

2.4 CATEGORY 5e BALANCED TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 5e cable at frequencies up to 100 MHz.

B. Standard: Comply with ICEA S-90-661, NEMA WC 63.1, and TIA-568-C.2 for Category 5e cables.

C. Conductors: 100 ohm, No. 24 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP) unless owner specific requirements require screened twisted pairs (F/UTP).

E. Cable Rating: Plenum.

F. Jacket: White thermoplastic unless otherwise specified by relevant specification section.

2.5 CATEGORY 6 BALANCED TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.

B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

C. Conductors: 100 ohm, No. 23 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP) unless owner specific requirements require screened twisted pairs (F/UTP).

E. Cable Rating: Plenum.

F. Jacket: White thermoplastic unless otherwise specified by relevant specification section.

2.6 CATEGORY 6a BALANCED TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500 MHz.

B. Standard: Comply with TIA-568-C.2 for Category 6a cables.

C. Conductors: 100 ohm, No. 23 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP) unless owner specific requirements require screened twisted pairs (F/UTP).

E. Cable Rating: Plenum.

F. Jacket: White thermoplastic unless otherwise specified by relevant specification section.

2.7 BALANCED TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.

B. General Requirements for Balanced Twisted Pair Cable Hardware:

1. Comply with the performance requirements of selected cable.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables must be terminated with connecting hardware of same category or higher.
4. Provide balanced twisted pair cable hardware suitable for the application and consistent with recommendations of manufacturer of respective device and/or equipment controlled by control wiring.

2.8 RS-232 CABLE

A. PVC-Jacketed, TIA 232-F:

1. Three or nine, No. 22 AWG, stranded (7x30) tinned copper conductors, as required by specific control application.
2. Polypropylene insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. PVC jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. NFPA 70 Type: Type CM.

7. Flame Resistance: Comply with UL 1581.

B. Plenum-Type, TIA 232-F:

1. Three or nine, No. 22 AWG, stranded (7x30) tinned copper conductors, as required by specific control application.
2. PE insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. Fluorinated ethylene propylene jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.9 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CMG.

1. Paired, one pair or two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors, as required by specific control application.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, one pair or two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors, as required by specific control application.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262.

2.10 CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One or multi-pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors, as required by specific control application.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One or multi-pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors, as required by specific control application.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.11 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

B. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway, Type XHHW-2, complying with UL 44 in raceway, power-limited cable, concealed in building finishes, or power-limited tray cable, in cable tray, based on application.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway, Type XHHW-2, complying with UL 44 in raceway, power-limited cable, concealed in building finishes, or power-limited tray cable, in cable tray, based on application.

2.12 SOURCE QUALITY CONTROL

A. Factory test twisted pair cables according to TIA-568-C.2.

B. Cable will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes must be no smaller than 2 inch (50 mm) wide, 3 inch (75 mm) high, and 2-1/2 inch (64 mm) deep.
2. Flexible metal conduit must not be used.

B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Raceway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering the room from overhead.
4. Extend conduits 3 inch (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96 inch (2440 mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at outlets, terminals, and cross-connect and patch panels.
2. Category 5e, 6, and 6A cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
3. Cables serving a common system may be grouped in a common raceway. Install control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
7. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
8. Provide strain relief.
9. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.

C. Installation and Support:

1. Support: Secure and support all control cables, including cables associated with building automatic systems (BAS), low voltage lighting controls, mechanical systems control cables, and all similar control and low-voltage cabling utilized for control of devices and equipment not associated with data and telecommunications systems which are covered by Division 27 and fire alarm, security, and specialty systems which are covered by Division 28, at intervals not exceeding 30 inch (760 mm) and not more than 6 inch (150 mm) from cabinets, boxes, equipment, fittings, outlets, racks, frames, and terminals. Provide supports (cable trays, j-hooks, raceway, etc.) as required; do not support control cabling from ceiling, conduits, ducts, equipment, etc.
2. Cabling not supported per the specification which is draped over ceilings, conduits, ducts, equipment, etc., will be rejected and require reinstallation in compliance with the support provisions of this specification.

D. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Install termination hardware as specified in Section 271513 "Communications Copper Horizontal Cabling" unless otherwise indicated.
3. Do not untwist balanced twisted pair cables more than 1/2 inch (12 mm) at the point of termination to maintain cable geometry.

E. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.
3. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment must be as follows:
   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inch (127 mm).
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inch (305 mm).
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inch (600 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment must be as follows:
   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inch (64 mm).
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inch (150 mm).
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inch (305 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures must be as follows:
   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inch (75 mm).
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inch (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inch (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inch (127 mm).

3.3 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No. 12 AWG.

3.5 FIRESTOPPING

A. Comply with requirements in Section 078400 "Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.6 GROUNDING

A. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969.

C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.

   a. Test instruments must meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 260523

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:
   1. Installation and Bonding of Grounding Electrodes including:
      a. Metal Underground Water Pipe
      b. Metal Frame of the Structure
      c. Concrete-Encased Electrodes including UFER Grounds
      d. Ground Ring
      e. Rod Electrodes
   2. Ground bonding common with lightning protection system.
   3. Foundation steel electrodes.
   4. Electrical Room Ground Bus.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Test wells.
   2. Grounding Electrodes
   3. Bonding Jumpers
   4. Electrical Room Grounding Bus.
   5. TEC and TDR Grounding Bus.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Instructions for periodic testing and inspection of grounding features at test wells based on NFPA 70B.
         1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
         2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Stranded Conductors: ASTM B 8.
   2. Tinned Conductors: ASTM B 33.
   3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.

C. Electrical Room Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V. Length as required for all specified terminations plus 25% spare but not less than 20 inches.

D. TEC and TDR Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V. Length as required for all specified terminations plus 25% spare but not less than 12 inches.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install stranded conductors unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum.
   1. Bury at least 18 inches (600 mm) below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in Normal Power Electrical Room, Essential Power Electrical Room, TEC and all TDR. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 96 inches (2400 mm) above finished floor unless otherwise indicated.

E. Conductor Terminations and Connections:
   1. Pipe Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Install tinned-copper conductor not less than No. 4/0 AWG from equipment grounding terminals to ground ring. Bury ground ring not less 18 inches below finished grade.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Metallic Fences: Comply with requirements of IEEE C2.
   1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
   2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are shall be at least 12 inches (300 mm) deep, with cover.
   1. Test Wells: Install one test well at the ground rod location indicated on the drawings.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through concrete footings.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Use exothermic-welded connectors; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate interior and exterior columns at distances not more than 60 feet (18 m) apart.
   1.

G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod.
   1. Install tinned-copper conductor not less than No. 4/0 AWG for bond to ground ring and for taps to building steel.
   2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.

H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4/0 AWG.
   1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
   2. Bond grounding conductor to reinforcing steel in at least four locations in mat footing and at four spread footing locations evenly distributed throughout building. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

I. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

J. Panelboard Bonding: To comply with NEC 517.14 panelboard bonding requirements install a minimum #10 AWG copper conductor between all branch-circuit panelboard grounding terminal buses in each electrical room. The conductor may be installed in ½" EMT conduit or may be exposed where securely fastened to the walls.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding conductor, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.
   4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed 3 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

B. Related Requirements:
   1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
      a. Hangers.
      b. Steel slotted support systems.
      c. Nonmetallic support systems.
      d. Trapeze hangers.
      e. Clamps.
      f. Turnbuckles.
      g. Sockets.
      h. Eye nuts.
      i. Saddles.
      j. Brackets.
   2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.
   1. Trapeze hangers. Include product data for components.
   2. Steel slotted-channel systems.
   3.
   4. Nonmetallic slotted-channel systems.
   5. Equipment supports.

6. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For hangers and supports for electrical systems.
1. Include design calculations and details of trapeze hangers.
2. Include design calculations for seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components.
2. Structural members to which hangers and supports will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Items penetrating finished ceiling, including the following:
   a. Lighting fixtures and lighting control.
   b. Electrical power devices
   c. Communications devices.
   d. Air outlets and inlets.
   e. Speakers.
   f. Fire sprinklers.
   g. Access panels.
   h. Projectors.
   i. Fire alarm system devices.
   j. Nurse call system devices.

B. Seismic Qualification Certificates: For hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
   2. Component Importance Factor: 1.5.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame Rating: Class 1.
   2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
   1. Material: Galvanized steel.
   2. Channel Width: Use 1-1/4 inches (31.75 mm) where possible and minimum 13/16 inches (20.64 mm) where necessary due to space restrictions.
   3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   4. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for electrical conductors in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include and are limited to the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 3/8 inch (9 mm) in diameter.

D. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with single-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70. Only prefabricated openings in structure members may be used. Do not create openings in structure members unless directed to do so by the structural engineer of record.

C. Cable Support Methods: Cables used for Circuits and Equipment Operating at Less Than 50 Volts and Class 1, 2 or 3 Remote-Control, Signaling and Power-Limited Circuits shall be installed in J-hooks. Where cables extend from J-hooks to equipment cables shall be supported from the structure by straps, hangers, cable ties or similar fittings designed and installed so as not to damage the cable. Do not fasten or secure cables to the raceways of the power system.

D. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on 13/16 inches (20.64 mm) slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete" or Section 033053 "Miscellaneous Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Section 099113 "Exterior Painting", Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 260533
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

B. Related Requirements:
1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. ARC: Aluminum Rigid Conduit.

B. EMT: Electrical Metallic Tubing.

C. GRC: Galvanized rigid steel conduit.

D. IMC: Intermediate metal conduit.

E. RTRC: Reinforced Thermosetting Resin Conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For color coded EMT conduit, surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. LEED Submittals:
1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. ARC: Comply with ANSI C80.5 and UL 6A.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797. Factory applied color finish available in black, orange, green, purple, red, yellow, blue, and white. Refer to Specification Section 260553 “Identification for Electrical Systems” for color coding of raceways.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for EMT:
      a. Material: Steel.
      b. Type: Set screw or compression.
   3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Continuous HDPE: Comply with UL 651B.

D. RTRC: Comply with UL 1684A and NEMA TC 14.

E. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Hinged type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.4 RECEPTACLE RACEWAYS

A. Listing and Labeling: Receptacle raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Aluminum with snap-on covers complying with UL. Clear anodized finish.
   1. Raceways for receptacles only: Wiremold AL3300 series.
   2. Raceways for applications where both receptacles and data devices are installed in the raceway and at all laboratory locations: Wiremold ALA4800 series two-channel and dual-cover. Satin anodized finish.
   3. Provide duplex receptacles at 12 inches on center in all receptacle raceways. Provide GFCI receptacles as noted on drawings.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Floor Boxes and Poke-Through Devices: Refer to Specification Section 262726 “Wiring Devices” for floor boxes and poke-through devices

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions:
   1. Wiring Devices other than data or communications devices: Minimum 4 inches square by 2-1/8 inches deep with switch ring as required for the device configuration and wall or ceiling surface. Where light switches are indicated at a common location provide multi-gang boxes to accommodate the quantity and type of switches indicated. Where deeper

boxes are required provide masonry type boxes which do not require a separate switch ring.

2. Data and communications devices: Minimum 4-11/16 inches square by 3 inches deep with single-gang 5/8 inch deep (or deeper if wall or ceiling finish is deeper) ring.

K. Pull boxes behind monitors: Minimum 6 inches square by 3-1/2 inches deep with two-gang ring.

L. Gangable boxes are prohibited.

M. Partitions: Provide partitions to separate emergency system conductors from conductors or other systems, where voltage between adjacent switches exceeds 300 volts and where switches controlling Low Voltage Controllers for interface to Nurse Call systems are installed in common boxes with line voltage switches.

N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250.
1. Indoor: Type 1 with continuous-hinge cover with flush latch unless otherwise indicated. Steel, finished inside and out with manufacturer's standard enamel.
2. Outdoor: Type 4X with continuous-hinge cover with flush latch unless otherwise indicated. 304 stainless steel with smooth brushed finish.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel. Provide interior panels when there are control devices or power blocks located inside the enclosure.

O. Handholes and Boxes for Exterior Underground Wiring: Refer to Specification Section 260543 “Underground Ducts and Raceways for Electrical Systems”.

2.6 PUTTY PADS

A. Moldable intumescent wall opening-protective pads designed for application to the back of electrical outlet boxes prior to installation of the wall finish to provide up to 2-hour fire barrier ratings and minimum Sound Transmission Class (STC) of 52 when tested in an STC-53 rated wall assembly or 59 according to ASTM E90-97.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M Company.
2. Hilti

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit for branch circuits: RNC, Type EPC-40-PVC, direct buried.
4. Underground Conduit for feeders: Refer to Specification Section 260543 “Underground Ducts and Raceways for Electrical Systems”.
5. Raceways Embedded in slabs or composite steel and concrete decks are prohibited.

6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
7. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X, 304 stainless steel.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms below 8 feet.
   d. Gymnasiums.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Feeder Raceways under Slabs: RNC, Type EPC-40-PVC encased in not less than 2 inches of 3000 psi concrete. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.
6. Branch Circuit Raceways under Slabs: Refer to Specifications Section 260519 “Low-Voltage Electrical Power Conductors and Cables” for allowable application of under slab raceways. RNC, Type EPC-40-PVC direct buried. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.
7. Raceways Embedded in slabs or composite steel and concrete decks are prohibited.
8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
9. Damp or Wet Locations: GRC or IMC.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X, 304 stainless steel in kitchens and damp or wet locations.
11.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply

with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Separation of Life Safety and Critical Branch Wiring: Comply with NFPA 70 Article 517.

C. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

D. Complete raceway installation before starting conductor installation.

E. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

F. Arrange stub-ups so curved portions of bends are not visible above finished slab except where concealed in chases.

G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

H. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

I. Support conduit within 12 inches (300 mm) of enclosures to which attached.

J. Raceways Embedded in Slabs are prohibited.

K. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

R. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

T. Surface Raceways:
1. Install surface raceway with a minimum 2-inch (50-mm)radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

U. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

X. Expansion(Seismic)-Joint Fittings:
1. Install flexible metal conduit at all locations where conduits cross building or structure expansion joints. Allow for minimum 4 inches deflection in all directions or greater if expansion joint exceeds 4 inches. Provide droop in flexible conduit to accommodate movement. Do not loop the flexible conduit. When calculating total bend degrees in conduit runs with expansion fittings use minimum 60 degrees for each expansion-joint fitting
2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations.

Z. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

CC. Locate boxes so that cover or plate will not span different building finishes.

DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

FF. Set metal floor boxes level and flush with finished floor surface.

GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING AND SOUND TRANSMISSION MITIGATION

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Install putty pads with acoustical and firestopping capabilities on all boxes that are installed in wall or partition cavities and in gypsum board ceilings.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260543
UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Spanish Fork Power Underground Power Construction Standards

1.2 SUMMARY

A. Section Includes:

1. Direct-buried conduit, ducts, and duct accessories.
2. Concrete-encased conduit, ducts, and duct accessories.
3. Transformer Pad/Vaults.

1.3 DEFINITIONS

A. RNC: Rigid Non-Metallic Conduit.

B. RTRC: Reinforced Thermosetting Resin Conduit (fiberglass).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include duct-bank materials, including separators and miscellaneous components.
2. Include ducts and conduits and their accessories, including elbows, end bells, bends, and fittings.
3. Include warning tape.

B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:

a. Include plans, elevations, sections, details, attachments to other work, and accessories.
b. Include duct entry provisions, including locations and duct sizes.
c. Include reinforcement details.
d. Include frame and cover design and pad-vault frame support rings.
e. Include grounding details.

f. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
g. Include joint details.

1.5 CLOSEOUT SUBMITTALS

A. Duct-Bank Record Drawings:
1. Indicate center line of each ductbank and conduit measured from a gridline.
2. Indicate elevation of each section of ductbank relative to the Hospital Building Level 1 Top-of- Slab elevation. Clearly identify all changes in elevation. Where ductbank is sloped provide a center line elevation at maximum every 10 feet.
3. Indicate location of crossings of piping of electrical and other systems.

1.6 FIELD CONDITIONS

A. Ground Water: Assume ground-water level is 36 inches (900 mm) below ground surface unless a higher water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

A. Comply with City of Spanish Fork Underground Power Construction Standards

B. Comply with ANSI C2.

2.2 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC, straight runs: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.

B. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.4 PRECAST VAULTS FOR PAD MOUNT SWITCHGEAR

A. Comply with Spanish Fork Power Services Underground Power Construction Standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of ducts, pad-vaults with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of ducts and duct-bank entrances into pad-vaults with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to pad-vaults and as approved by Architect.

C. Clear and grub vegetation to be removed and protect vegetation to remain according to Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 311000 "Site Clearing."

3.2 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables More than 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank.

B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank.

3.3 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top-soil, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" Article in Section 017300 "Execution."

3.4 DUCT INSTALLATION

A. Install ducts according to NEMA TCB 2.

B. Slope: Pitch ducts a minimum slope of 1:300 down toward pad-vaults and away from buildings and equipment.

C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1200 mm) for 4 inch conduits and 60 inches for 6 inch conduit both horizontally and vertically, at other locations unless otherwise indicated.

D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

E. Duct Entrances to Pad-vaults: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 6-inch (125-mm) ducts and 7.5 inches for 4-inch ducts.

1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
2. Grout end bells into structure walls from both sides to provide watertight entrances.

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

G. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in empty ducts.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than or equal to 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 4 inches (75 mm) wider than duct bank on each side.
3. Depth: Install top of duct bank at least 36 inches (600 mm) below finished grade except that tunnel crossing may be not less than 12” below top of slab. Where crossing grade beams install conduits at minimum 2 inches below bottom of grade beam.
4. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
5. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
6. Minimum Space between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
7. Minimum Center to Center dimension: 7.5 inches.
8. Elbows: Use manufactured RTRC conduit elbows for stub-ups at equipment and at changes of direction in duct run.

a. Couple RTRC conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.

9. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
10. Concrete Cover: Install a minimum of 4 inches (75 mm) of concrete cover at top and bottom, and a minimum of 2 inches (50 mm) on each side of duct bank.
11. Concreting Sequence: Pour each run of envelope between pad-vaults or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (15-mm) reinforcing-rod dowels extending a minimum of 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.

12. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

I. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.5 INSTALLATION OF CONCRETE PADS AND VAULTS

A. Precast Concrete Pad-vault Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Pad-vault Pad Lid: Install with pad at 4 inches above finished grade.

C. Drainage: Install drains in bottom of pad-vaults where indicated. Coordinate with drainage provisions indicated.

D. Dampproofing: Apply dampproofing to exterior surfaces of pad-vaults after concrete has cured at least three days. Dampproofing materials and installation are specified in Section 071113

"Bituminous Dampproofing." After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars.

E. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms,as required for installation and support of cables and conductors and as indicated.

F. Field-Installed Bolting Anchors in Pad-vaults: Do not drill deeper than 3-7/8 inches (97 mm) for pad-vaults for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.6 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- (150-mm-) long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test pad-vault grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.8 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of pad-vaults, including sump. Remove foreign material.

END OF SECTION

SECTION 260544
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:
1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:
1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:
1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

A. Fire-Rated Assemblies for Low Voltage Penetrations (Communications, etc.): Engineered prefabricated fire stop system. The acceptable manufacturers of firestop systems are:
1. STI Firestop (EZ-Path)

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
   2. Sealant shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors 4 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

1.2 SLEEVE-SEAL FOR FIRE RATED ELECTRICAL PENETRATIONS

A. Fire-Rated Assemblies for Low Voltage Penetrations (Communications, etc.): Install listed firestop system from one of the acceptable manufacturer products listed below during construction of floor or wall at each point where communications cabling, cable tray, conduit, sleeves, etc., penetrate a fire-rated assembly. The acceptable manufacturers of firestop systems are:
   1. STI EZ-Path

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 260548
SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Restraint channel bracings.
   2. Restraint cables.
   3. Seismic-restraint accessories.
   4. Mechanical anchor bolts.
   5. Adhesive anchor bolts.

B. Related Requirements:
   1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
      b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Delegated-Design Submittal: For each seismic-restraint device.
   1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional or structural engineer responsible for their preparation.
   2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints and for designing vibration isolation bases.
      a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
   3. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional or structural engineer.

C. Welding certificates.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Observation Report signed by the professional or structural engineer responsible for the design calculations and details for the seismic restraint devices indicating that all restraints have been installed and tested per the approved action submittal documents.

1.6 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading: Refer to Structural criteria for the project.

2.2 RESTRAINT CHANNEL BRACINGS

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

A. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.6 ADHESIVE ANCHOR BOLTS

A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete" and Section 033053 "Miscellaneous Cast-in-Place Concrete."

B. Equipment and Hanger Restraints:
   1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
   2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.

B. Seismic controls will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels, including arc-flash warning labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Use the following color code for all electrical equipment and junction boxes that are specified to be labeled:
   1. Standby Power Circuits: Black letters on red field.
   2. Life Safety Branch Circuits: White letters on orange Field
   3. Critical Branch Circuits: White letters on red Field
   4. Equipment System Circuits: White letters on green field.
   5. Normal Power Circuits: White letters on black field.
   6. Uninterruptible Power Supply (UPS):
      a. UPS-A: Blue letters on a grey field.
      b. UPS-B: Red letters on a grey field.
   7. Fire Alarm: Red letters on white field.
   8. Communications: White letters on blue field.

B. Warning labels and signs shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR XX INCHES" where XX is replaced by the clearance requirements of NFPA 70.

C. Use the following color code for all electrical raceways that are specified to be labeled:
   1. Color Coding for Raceways:
      a. Standby Power: Black
      b. Life Safety Branch: Yellow
      c. Critical Branch: Orange
      d. Equipment Branch: Green
      e. UPS: White
      f. Fire alarm: Red
      g. Communications: Blue
      h. Access Control: Purple
   2. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: where voltage, system type, or other written information is required, black lettering on orange background.

D. Labels on receptacle and switch cover plates shall match the respective plate color.

2.3 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: printed, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Indoor Equipment Labels: Self-adhesive, engraved, laminated acrylic or melamine plastic label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high. Color coded as indicated in Color and Legend Requirements.

C. Outdoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high. Color coded as indicated in Color and Legend Requirements.

2.4 BANDS AND TUBES:

A. Snap-Around, Color-Coding Bands for Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

2.5 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.6 SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:
   1. Engraved legend.
   2. Thickness:
      a. For signs up to 20 sq. inches (129 sq. cm), minimum 1/16-inch- (1.6-mm-).
      b. For signs larger than 20 sq. inches (129 sq. cm), 1/8 inch (3.2 mm) thick.
      c. Engraved legend with white letters on a dark grey background.
      d. Punched or drilled for mechanical fasteners.
      e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. System Identification for Feeder Raceways: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

I. Fire Alarm: Provide raceway with factory applied finish or paint conduit in field.

J. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

3.3 IDENTIFICATION SCHEDULE

A. Switchboards and Panelboards: Include Identification per the One-Line Diagrams and the Source Location, including the circuit number.

B. Disconnect Switches, Enclosed Circuits Breakers and Motor Controllers. Identify the equipment that is controlled and the Source, including the circuit number.

C. Accessible Raceways, including above accessible ceilings, for all Feeder Circuits and for Branch Circuit rated more than 30A: Identify with self-adhesive tape or vinyl label. Install labels at 30-foot (10-m) maximum intervals.

D. Accessible Raceways and Cables, including above accessible ceilings, within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels indicating the wiring system and system voltage. Conform to system color legend/schedule.
   1. Standby Power
   2. Life Safety Branch
   3. Critical Branch
   4. Equipment System
   5. Normal Power
   6. UPS
   7. Fire Alarm
   8. Communications
   9. Access Control

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
   1. Grounded Systems: Color-Coding for Phase- , Neutral- and Voltage-Level Identification: Use colors listed below for feeder and branch-circuit conductors.
      a. Colors for 208/120-V Circuits:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Feeder Neutral: White
         5) Branch Circuit Neutral: White with colored stripe matching the color of the phase circuit that is paired with the neutral.
      b. Colors for 480/277-V Circuits:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Feeder Neutral: Grey
         5) Branch Circuit Neutral: Grey with colored stripe matching the color of the phase circuit that is paired with the neutral.
   2. Isolated Power Systems: Color-Coding for Circuit Identification: Use colors listed below for Isolated Power conductors.
      a. Isolated Conductor No.1: Orange with at least one distinctive colored stripe other than white, green, or grey along the entire length of the conductor.
      b. Isolated Conductor No. 2: Brown with at least one distinctive colored stripe other than white, green, or grey along the entire length of the conductor.
   3. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
      a. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
   4. Provide a sign at each panelboard identifying the color coding scheme.

F. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive vinyl labels with the conductor designation.

I. Conductors To Be Extended in the Future: Attach write-on tags to conductors and list source.

J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
   3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

K. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for direct-buried cables and cables in raceways.

L. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
   1. Comply with 29 CFR 1910.145.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
      a. Power-transfer switches.
      b. Controls with external control power connections.

N. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
   1. Comply with NFPA 70E and ANSI Z535.4.
   2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.

O. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

P. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer or load shedding.

Q. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   b. Fasten mechanically fastened labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment To Be Labeled:
   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer.
   b. Enclosures and electrical cabinets.
   c. Lighting control relay cabinets.
   d. Access doors and panels for concealed electrical items.
   e. Switchgear.
   f. Switchboards.
   g. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   h. Emergency system boxes and enclosures.
   i. Motor-control centers.
   j. Enclosed switches.
   k. Enclosed circuit breakers.
   l. Enclosed controllers.
   m. Variable-speed controllers.
   n. Push-button stations.
   o. Power-transfer equipment.
   p. Contactors.
   q. Remote-controlled switches, dimmer modules, and control devices.
   r. Battery-inverter units.
   s. Battery racks.
   t. Power-generating units.
   u. Monitoring and control equipment.
   v. UPS equipment.
   w. Communications Equipment Racks.
   x. Fire Alarm System.
   y. Access Control System.
   z. Overhead Paging System.
   aa. Nurse Call System.

END OF SECTION

SECTION 26 05 72
OVERCURENT PROTECTION DEVICE SHORT-CIRCUIT STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
   1. Short-circuit study input data, including completed computer program input data sheets.
   2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.
      a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient

study data to ensure that the selection of devices and associated characteristics is satisfactory.

b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

3. Electronic copies of all studies that are performed and reports that are produced by SKM software in a format that is useable by SKM Power Tools Deliver on thumb drive or external hard drive which will not be returned.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Short-Circuit Study Specialist.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 QUALITY ASSURANCE

A. Studies shall SKM Power Tools Software. Manual calculations are unacceptable.

B. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

C. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. SKM Systems Analysis, Inc.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.

3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.

G. Short-Circuit Study Output:
1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Equivalent impedance.
2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Calculated asymmetrical fault currents:
      1) Based on fault-point X/R ratio.
      2) Based on calculated symmetrical value multiplied by 1.6.
      3) Based on calculated symmetrical value multiplied by 2.7.
3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Obtain all data necessary for the conduct of the study.
   1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Architect.
   2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
   3. For relocated equipment and that which is existing to remain or to modified, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
   1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Obtain electrical power utility impedance at the service.
   3. Power sources and ties.
   4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
   5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
   6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
   7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
   8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
   9. Motor horsepower and NEMA MG 1 code letter designation.
   10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the secondary of the point of connection to Provo City Power which is at the line side of the existing primary meter and at the generator outputs, extending down to the system overcurrent protective devices as follows:
   1. To normal system low-voltage load buses where fault current is 10 kA or less.
   2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.
   1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

H. Assume 10 kA

I. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:
   1. Electric utility's supply termination point.
   2. Incoming switchgear.
   3. Medium voltage transformer primary and secondary terminals.
   4. Low-voltage switchgear.
   5. Motor-control centers.
   6. Control panels.
   7. Standby generators and automatic transfer switches.
   8. Branch circuit panelboards.
   9. Disconnect switches.
   10. Power Transfer equipment.

3.3 ADJUSTING

A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.4 DEMONSTRATION

A. Train Owner's operating and maintenance personnel in the use of study results.

END OF SECTION

SECTION 26 05 73
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
   1. Coordination-study input data, including completed computer program input data sheets.
   2. Study and equipment evaluation reports.
   3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.
      a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment

manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Coordination Study Specialist and Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. The following parts from the Protective Device Coordination Study Report:
         1) One-line diagram.
         2) Protective device coordination study.
         3) Time-current coordination curves.
      b. Power system data.
   2. Electronic copies of all studies that are performed and reports that are produced by SKM software in a format that is useable by SKM Power Tools Deliver on thumb drive or external hard drive which will not be returned.

1.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
   1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. SKM Systems Analysis, Inc.

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
   1. Optional Features:
      a. Arcing faults.
      b. Simultaneous faults.
      c. Explicit negative sequence.
      d. Mutual coupling in zero sequence.

2.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:
   1. Protective device designations and ampere ratings.
   2. Cable size and lengths.
   3. Transformer kilovolt ampere (kVA) and voltage ratings.
   4. Motor and generator designations and kVA ratings.
   5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study:
   1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
      a. Phase and Ground Relays:

1) Device tag.
2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
3) Recommendations on improved relaying systems, if applicable.

b. Circuit Breakers:
1) Adjustable pickups and time delays (long time, short time, ground).
2) Adjustable time-current characteristic.
3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination for the period of time that a fault's duration extends beyond 0.1 second. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:
   a. Power utility's overcurrent protective device.
   b. Medium-voltage equipment overcurrent relays.
   c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
   d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
   e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
   f. Cables and conductors damage curves.
   g. Ground-fault protective devices.
   h. Motor-starting characteristics and motor damage points.
   i. Generator short-circuit decrement curve and generator damage point.
   j. The largest feeder circuit breaker in each motor-control center and panelboard.
5. Provide adequate time margins between device characteristics such that selective operation is achieved.
6. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:
   1. To normal and emergency systems low-voltage load buses where fault current is 10 kA or less.
   2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:
   1. Device shall not operate in response to the following:
      a. Inrush current when first energized.
      b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
      c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
   2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

I. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.

J. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.
   1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

K. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:
   1. Electric utility's supply termination point.
   2. Switchgear.
   3. Low-voltage switchgear.
   4. Motor-control centers.
   5. Standby generators and automatic transfer switches.
   6. Branch circuit panelboards.

L. Protective Device Evaluation:
   1. Evaluate equipment and protective devices and compare to short-circuit ratings.
   2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.

3.3 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:
   1. Determine load-flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
   2. Determine load-flow and voltage drop based on 80 percent of the design capacity of the load buses.
   3. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.4 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.
   1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
   2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
   3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
   1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Electrical power utility impedance at the service.
   3. Power sources and ties.

4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
17. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.

3.5 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.6 DEMONSTRATION

A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:
   1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.
   2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.
   3. Adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION

SECTION 26 05 74
OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form.
   1. Arc-flash study input data, including completed computer program input data sheets.
   2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.
      a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Arc-Flash Study Specialist.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

B. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

C. Electronic copies of all studies that are performed and reports that are produced by SKM software in a format that is useable by SKM Power Tools Deliver on thumb drive or external hard drive which will not be returned.

1.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
   1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:
   1. Protective device designations and ampere ratings.
   2. Cable size and lengths.
   3. Transformer kilovolt ampere (kVA) and voltage ratings.
   4. Motor and generator designations and kVA ratings.
   5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

G. Arc-Flash Study Output:
   1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
      a. Voltage.
      b. Calculated symmetrical fault-current magnitude and angle.
      c. Fault-point X/R ratio.
      d. No AC Decrement (NACD) ratio.
      e. Equivalent impedance.
      f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
      g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Incident Energy and Flash Protection Boundary Calculations:
   1. Arcing fault magnitude.
   2. Protective device clearing time.
   3. Duration of arc.
   4. Arc-flash boundary.
   5. Working distance.
   6. Incident energy.
   7. Hazard risk category.
   8. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
   1. Location designation.
   2. Nominal voltage.
   3. Flash protection boundary.
   4. Hazard risk category.
   5. Incident energy.
   6. Working distance.
   7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies:
   1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

2. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

C. Calculate maximum and minimum contributions of fault-current size.
1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:
1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.
1. Verify completeness of data supplied on the one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control

of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.4 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:
   1. Motor-control center.
   2. Low-voltage switchboard.
   3. Switchgear.
   4. Medium-voltage switch.
   5. Control panel.

3.5 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.6 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION

SECTION 26 08 00
ELECTRICAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes general requirements that apply to implementation of commissioning. The commissioned systems for this project are as follows:

1. Electrical systems consisting of: emergency power supply systems - transfer switches, and generators, lighting control, Uninterruptable Power Supply.

B. RELATED SECTIONS:
1. Division 01 Section 019113: General Commissioning Requirements.
2. Division 26 Section 260800: Electrical Commissioning Requirements
3. Division 26 Section 260923: Lighting Control.
4. Division 26 section 260313: Low-Voltage Paralleling Switch Gear
5. Division 26 section 260600: Transfer Switches
6. Division 26 section 262923: Variable-Frequency Motor Controller
7. Division 26 Section 263213: Engine Generators.

C. Commissioning is a comprehensive and systematic process to verify that the building systems perform as designed to meet the owner's requirements. Commissioning during the design, construction, acceptance, and warranty phases is intended to achieve the following specific objectives:

1. Verify and document that equipment is installed and started per manufacturer's recommendations and to industry accepted standards.
2. Verify and document that equipment and systems receive complete operational checkout by installing contractors.
3. Verify and document equipment and system performance.
4. Verify the completeness of operations and maintenance materials.
5. Ensure that the owner's operating personnel are adequately trained on the operation and maintenance of building equipment.

D. For lighting control, complete the requirements to meet the LEED pre-requisite for Fundamental Commissioning of Building Energy Systems and the LEED credit for Enhanced Commissioning.

E. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

1.3 DEFINITIONS

A. A/E – Architect and Engineer on the design team.

B. BOD - Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

C. Cx Plan - Commissioning Plan. A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

D. CxA - Commissioning Authority.

E. EOR – Engineer of Record.

F. FPT – Functional Performance Test. FPTs can be multi-discipline and multi-trade activities that require choreographing and rehearsing with the project team.

G. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

H. OPR - Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

I. PFC - Pre-Functional Checklist. The PFC documents the construction status of the equipment or system and ensures that pre-requisite systems and checks are completed prior to energizing and operating the equipment. Upon completion of the PFC, the equipment and / or systems are complete and operational, so that the functional performance testing can be scheduled. The PFC may require that a start-up certification from the vendor, control points lists, and sequence verification forms are attached.

1.4 COMMISSIONING TEAM

A. At a minimum, the members of the commissioning team consist of the Commissioning Agent (CxA), the Owner’s Representative (PM), the General Contractor (GC or Contractor), the architect and design engineers (A/E), the Mechanical Contractor (MC), the Electrical Contractor (EC), the Controls Contractor (CC), the Test and Balance Contractor (TAB), the owner’s maintenance staff, and any other installing subcontractors or suppliers of equipment.

B. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

C. All applicable sub-contractors shall include cost for their involvement in the commissioning process including demonstration of installed equipment to the commissioning team members during the acceptance portion of the project, and other responsibilities as described in the specification.

D. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 COMMISSIONING PROCESS

A. The following activities describe the commissioning tasks during construction and the general order in which they occur. The commissioning provider coordinates all activities.

1. Kick-Off Meeting. Appropriate members of the design and construction team that will be involved in the commissioning process will attend a commissioning scoping meeting to be introduced to the requirements of the commissioning: checklists, tests, scope of work, schedule, tasks, and contractor responsibilities with regard to the implementation of the Commissioning Plan.
2. Commissioning Plan. The commissioning plan provides guidance in the execution of the commissioning process.
3. Submittals. Equipment submittals are to be submitted by the contractor to the CXA and concurrently to the EOR for review and approval for the all equipment and systems to be commissioned (refer to section 1.2.A).
4. Start-Up/Pre-Functional Checklists. The CxA works with the contractors to develop start-up plans and a start-up schedule. Pre-functional checklists verify readiness for commissioning. Pre-functional checklists will be provided to the contractors by the commissioning agent to be completed during the startup process. Pre-functional checklists may be provided by the contractor, as a substitute to the Pre-functional checklists provided by the CxA, with prior review and approval by the CxA. Completion of the Pre-functional checklists indicates readiness for functional testing. If the CxA is notified by the installing contractor that the systems are ready for testing, and the CxA is unable to test because of the state of system readiness, the installing subcontractor will be back charged for the CxA's time and expense at the current year's labor rate for the CxA.
5. Functional Performance Testing. The objective of functional performance testing is to demonstrate that each system is operating in accord with the sequence of operations, OPR, BOD and Construction Documents. Each functional performance test (FPT) verifies that all system components, and interfaces between systems operate correctly. This includes all operating modes, interlocks, control sequences, and responses to emergency

conditions. All FPT procedures are written, directed, witnessed, and documented by the CxA. Any testing or manipulation of electrical power, interlocks, alarms or system controls will be by the installing contractor.

6. Deficiencies and Resolution. The CxA documents items of non-compliance in materials, installation or operation. In collaboration with the entity responsible for system and equipment installation, perform corrective action until the issues are resolved to the satisfaction of the owner or the CxA. When the deficiencies are rectified, the contractor will notify the CxA for final re-testing. Any subsequent re-testing due to un-resolved deficiencies will be back charged to the contractor for the CxA's time and expense at the current year's labor rate for the CxA.
7. Operations and Maintenance Documentation. The CxA reviews the O&M documentation for completeness.
8. Training. The CxA reviews the training provided by the contractors and verifies that it is completed.

1.6 SUBMITTALS

A. The CxA will require submittals for all commissioned equipment to formulate the pre-functional tests and functional tests. Additionally, the CxA reviews submittals related to the commissioned equipment and their controls for conformance to the OPR, BOD and Construction Documents. Equipment submittals are to be submitted by the contractor to the CXA and concurrently to the EOR for review and approval for the all equipment and systems to be commissioned (refer to section 1.2.A).

B. The CxA may submit written requests for additional information from contractors to facilitate the commissioning process.

C. The CxA may request additional design and operations narrative from the design team and Electrical Contractor.

1.7 REPORTING

A. The CxA will provide regular reports to the Owner and the GC with increasing frequency as construction and the process of commissioning progresses.

B. The CxA will regularly communicate with all members of the commissioning team, apprising them of commissioning progress and scheduling changes through memos, progress reports, etc.

C. The CxA compiles a final Commissioning Report which summarizes all of the tasks, findings, and documentation of the commissioning process. The report addresses the actual performance of the building systems in reference to the design intent and contract documents. The report includes completed pre-functional inspection checklists, functional performance testing records, diagnostic monitoring results, identified deficiencies, recommendations, and a summary of commissioning activities.

1.8 MEETINGS

A. Kick-off Meeting. The CxA will schedule, plan and conduct a commissioning Kick-off meeting with the entire commissioning team in attendance. The CxA will distribute meeting minutes to all parties.

B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CxA as construction progresses as appropriate. These meetings will cover coordination, deficiency resolution and planning issues. The attendance of a representative of each subcontractor on the commissioning team will be required.

PART 2 - RESPONSIBILITIES

2.1 The responsibilities of various parties in the commissioning process are provided in the following sections. Note that the services for the Owner, Design Team, and Commissioning Provider are not included in this contract. The Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process only.

2.2 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and each Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the OPR prepared by the Owner and provide the BOD documentation, prepared by Design Engineers/Architect and approved by Owner, to the CxA and each Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

2.3 ARCHITECT & ENGINEER(s) OF RECORD’S RESPONSIBILITIES(A/E)

A. Construction and Acceptance Phase
1. Attend the commissioning kick-off meeting and selected commissioning team meetings.
2. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted and provide a copy to the CxA.
3. Provide design narrative documentation requested by the CxA.
4. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
5. Resolve issues identified by the CxA that are related to errors in design.
6. Prepare and submit final as-built BOD documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

B. Warranty Period
1. Coordinate resolution of design non-conformance and design deficiencies identified during warranty period commissioning.

2.4 GENERAL CONTRACTOR (GC)

A. Construction and Acceptance Phase
1. Facilitate the coordination of the commissioning work by the CxA.
2. Integrate all commissioning activities into the master construction schedule. The schedule will include the following information for each piece of equipment: Factory acceptance tests, pre-functional testing, equipment functional testing, system performance testing and site integration testing.
3. A representative shall attend a commissioning kick-off meeting and other necessary meetings scheduled by the CxA to facilitate the commissioning process.
4. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment and systems to the CxA.
5. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
6. Ensure that all subcontractors execute their commissioning responsibilities according to this specification and the commissioning plan.
7. Ensure that equipment vendors (or their local representative) that are required to perform on site start-up will attend functional testing. GC is to include this clause in specified vendor's RFP.
8. Coordinate the sub-contractors and equipment vendors for required Pre-Functional and Functional Performance testing including testing that requires multi-discipline and multi-trade activities.
9. Ensure that Subcontractors correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings per the issues identified by the CxA.
10. Coordinate the training of owner personnel.
11. Prepare O&M manuals, as-builts (including clarifying and updating the original sequences of operation to as-built conditions), warranties, spare parts, submittals and submittal logs, RFI's and RFI logs, etc according to the format developed by the CxA , in coordination with the Engineer, and reviewed and approved by the Owner. The documents shall be submitted by the Contractor to the Commissioning Authority both electronically and in hard copy. All electronic PDF documents shall be searchable with bookmarks mimicking the tabs in the binder.

B. Warranty Period
1. Ensure that subcontractors execute required seasonal or deferred functional performance testing.
2. Ensure that subcontractors correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for issues identified in seasonal testing.

2.5 INSTALLING CONTRACTORS RESPONSIBILITIES: (Electrical Contractor (EC)

A. The responsibilities of Contractors in the commissioning process are provided in this section to clarify the commissioning process.

B. Contractors shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
1. The CxA will work with the GC to schedule commissioning activities. The GC shall integrate all commissioning activities into the master construction schedule. All parties

will address scheduling issues in a timely manner in order to expedite the commissioning process.

2. Equipment submittals are to be submitted by the contractor to the CXA and concurrently to the EOR for review and approval for the all equipment and systems to be commissioned (refer to section 1.2.A).
3. Attend Commissioning and Coordination Meetings during the construction, acceptance and warranty phases as designated by the CxA.
4. Attend construction phase controls coordination meeting.
5. Integrate and coordinate commissioning process activities into the construction schedule.
6. Document equipment installation, testing, and startup activities as defined by the manufacturer and provide to the CxA as supporting documents attached to the Pre-Functional Checklists.
7. Labor, instrumentation, tools, and test equipment costs for technicians for the performance of commissioning pre-functional equipment checks and functional performance testing are to be provided by the contractor responsible for the installation of the equipment or system to be commissioned. Tools and test equipment are to be calibrated and in good working order. Testing equipment calibration certifications must be current in accordance with all requirements of the Project Manual.
8. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period as designated by the CxA.
9. Perform the pre-functional equipment checks and document these requirements and tests in the pre-functional checklists provided by the CxA. Contractor is to deliver the pre-functional checklists completed and signed to the CxA, along with supporting documentation for all commissioned equipment and systems one (1) week prior to Functional Performance Testing. All completed pre-functional checklists must be approved by the Commissioning Agent before functional performance testing is started. If the contractor indicates inaccurate completion of these checklists, and it results in the CxA unable to perform the Functional Performance Tests, the contractor will be back charged for the CxA's time and expense at the current year's labor rate for the CxA.
10. Review the commissioning process functional test procedures (Functional Performance Tests – FPTs) provided by the Commissioning Authority. Testing will include all operation and alarm modes.
11. At least one (1) week prior to functional performance testing the Contractors will provide written verification that all electrical connections are complete, dust making activities have ceased, all control's point to point verification is completed, all commissioned systems and equipment start-ups are completed, Pre-Functional Checklists and Pre-Functional Verification Forms Completed and signed, all equipment to be commissioned is in operation, and O&M Manuals are available.
12. Address current A/E punch list items before functional testing.
13. The Contractor(s) will demonstrate and perform commissioning process functional performance tests under the direction of the CxA and with the CxA acting as a witness to the tests. If the functional performance tests result in deficiencies, the contractor will be given an Issues Log listing the deficiencies discovered during testing. When the deficiencies are rectified, the contractor will notify the CxA for final re-testing. Any subsequent re-testing due to un-resolved deficiencies will be back charged to the contractor for the CxA's time and expense at the current year's labor rate for the CxA.
14. Cooperate with the CxA for resolution of issues recorded in the Issues Log, Construction Observation and test reports. In collaboration with the entity responsible for system and equipment installation, perform corrective action until the issues are resolved to the satisfaction of the owner or the CxA.

15. Participate in systems, assemblies, equipment, and component maintenance orientation and inspection as called out in the installation specifications.
16. Provide the CxA with training curricula for review and approval for all commissioned equipment and systems a minimum of four weeks prior to the scheduled training. Provide a record of attendance for Owner's Operation and Maintenance Training on required commissioned systems.
17. Provide EOR and CxA with site specific copies of Operation and Maintenance Manuals detailing all manufacturer's recommended maintenance procedures and spare parts lists for review and approval for all commissioned equipment and systems a minimum of four weeks prior to submission for substantial completion.
18. Provide "As Built" drawings for all commissioned equipment and systems to the EOR and the CxA for review and approval.

C. If the installing contractor requires the vendor to perform start-up, then the factory start-up technician or qualified local representative will be required to attend functional testing.

2.6 ADDITIONAL RESPONSIBILITIES FOR LIGHTING CONTROLS (EC)

A. Upon completion of the installation, Contractor will provide evidence (pre-functional checklists with acceptance signatures) to the Commissioning Agent that all:
1. Analog input points have been tested and calibrated.
2. Digital input points have been tested.
3. Analog output points stroke / function properly.
4. Digital output points operate properly.

B. Work with the Commissioning Agent to develop tuning validation tests using appropriate trend logs to show that control loops have been properly tuned to optimize energy usage while maintaining stable operation and occupant comfort.

C. Commissioning Tools Graphic shall be created for each unique System for Global override of positions or set points to assist in commissioning. Graphic shall be accessible from each System or Unitary Graphic. A commissioning graphic for the chilled water system would allow all of the cooling control valves to be opened or closed. A graphic would provide temperature override to all zones in the building, similar graphics will be created for all other systems.

2.7 ADDITIONAL RESPONSIBILITIES FOR ELECTRICAL CONTRACTOR (EC)

A. The Contractor(s) will demonstrate and perform all required construction related electrical testing with the CxA acting as a witness to the tests sufficient to demonstrate the procedures. If the tests result in deficiencies, the contractor will be given an Issues Log listing the deficiencies discovered during testing. When the deficiencies are rectified, the contractor will notify the CxA for final re-testing. Any subsequent re-testing due to un-resolved deficiencies will be back charged to the contractor for the CxA's time and expense at the current year's labor rate for the CxA.

B. All tools, instruments, equipment, and labor required to execute field quality testing specified in the 26 00 00 electrical specifications will be by the contractor.

2.8 Provide specialize test instrumentation for functional testing including but not limited to mega-ohmmeters, power quality meters, noise level measurements, load banks, temporary cabling, 3 phase transient meters, phase rotation meter, Battery Integrity and Capacity Load Tester, Battery hydrometer and Infrared Camera

2.9 Set all trip units according to the Coordination Study. CxA to review the final settings report and verify 10% of trip unit settings

2.10 EQUIPMENT SUPPLIERS

A. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.

B. If the installing subcontractor requires the vendor to perform start-up, then the factory start-up technician or qualified local representative will be required to attend functional testing and assist in equipment testing after start-up.

C. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

2.11 CxA RESPONSIBILITIES

A. The primary role of the CxA is to develop and coordinate the execution of a Cx plan, observe construction and testing. The CxA will document that the performance of the commissioned systems are functioning in accordance with the documented OPR, BOD and the Contract Documents. The CxA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E team.

B. Coordinates and directs all commissioning activities. Work with the GC and PM to ensure that commissioning activities are being scheduled.

C. Plan and conduct the commissioning kick-off meeting.

D. Review Contractor submittals applicable to commissioned systems, concurrent with the EOR reviews.

E. Provide and revise as necessary, the commissioning plan (Cx Plan).

F. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures, and sequences of operation.

G. Perform site visits, as contracted, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress.

H. The CxA develops project-specific construction checklists (pre-functional checklists), commissioning process test procedures (Functional Performance Tests – FPTs, for the equipment and systems to be commissioned. These procedures are based on the construction documents prepared by the design team as well as the OPR and BOD. The tests include step by step descriptions of each activity in chronological order including duration, required personnel, and back out procedure for each step. Test scripts shall also include any requirements for supplemental monitoring equipment and radio communications during the tests. FPTs, are multi-discipline and multi-trade activities that may require choreographing and rehearsing with the contractors and Cx Team members. All verification procedures are directed, witnessed, and documented by the CxA, with other parties present as appropriate.

I. Coordinate, witness, and document functional performance tests performed by installing contractors. Coordinate a final re-testing to determine whether a satisfactory performance is achieved.

J. Prepare and maintain the Issues Log.

K. Review and witness systems, assemblies, equipment, and component startup.

L. Compile commissioning test data, inspection reports, and checklists; include them in the systems manual and final commissioning report.

M. Review the Operation and Maintenance Manuals.

N. Review Owner Operation and Maintenance training curricula and document owner training has taken place as required.

END OF SECTION

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Photoelectric switches.
2. Standalone daylight-harvesting switching controls.
3. Daylight-harvesting dimming controls.
4. Room Controllers.
5. Stand Alone Indoor occupancy sensors.
6. Lighting contactors.
7. Emergency shunt relays.
8. Low-Voltage Controllers

B. Related Requirements:
1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, low voltage dimmers, low voltage switches, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.
1. Submit complete scale drawing showing recommended location for each sensor, optimized for project conditions and coverage patterns for submitted devices.
2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.
4. Include legend for each light switch keyed to the lighting control shop drawings indicating engraving/labelling factory applied to each switch.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Leviton Manufacturing Co., Inc.
4. NSi Industries LLC.
5. TE Connectivity Ltd.

B. Description: Solid state, with SPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range.
3. Time Delay: Thirty-second minimum, to prevent false operation.
4. Lightning Arrester: Air-gap type.
5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.2 DAYLIGHT-HARVESTING SWITCHING CONTROLS

A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 260943, Relay Based Lighting Controls.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton (Cooper Controls), Inc.
2. Lutron, Inc.
3. Leviton Manufacturing Co., Inc.
4. Philips Controls
5. Acuity Controls
6. Nextlite
7. ETC
8. Douglas Controls
9. WattStopper

C. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with separate power pack, to detect changes in indoor lighting levels that are perceived by the eye.

D. Electrical Components, Devices, and Accessories:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
3. Sensor Output: Contacts rated to operate the associated power pack, complying with UL 773A. Sensor is powered by the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. General Space Sensors Light-Level Monitoring Range: 10 to 200 fc (108 to 2152 lux), with an adjustment for turn-on and turn-off levels within that range.
6. Atrium Space Sensors Light-Level Monitoring Range: 100 to 1000 fc (1080 to 10 800 lux), with an adjustment for turn-on and turn-off levels within that range.
7. Skylight Sensors Light-Level Monitoring Range: 1000 to 10,000 fc (10 800 to 108 000 lux), with an adjustment for turn-on and turn-off levels within that range.
8. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.
9. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.
10. Test Mode: User selectable, overriding programmed time delay to allow settings check.
11. Control Load Status: User selectable to confirm that load wiring is correct.
12. Indicator: Two digital displays to indicate the beginning of on-off cycles.

2.3 DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 260943, Relay Based Lighting Controls.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton (Cooper Controls), Inc.
2. Lutron, Inc.
3. Leviton Manufacturing Co., Inc.
4. Philips Controls
5. Acuity Controls
6. NextLite
7. Douglas Controls
8. ETC
9. WattStopper

C. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
1. Lighting control set point is based on two lighting conditions:
   a. When no daylight is present (target level).
   b. When significant daylight is present.
2. System programming is done with two hand-held, remote-control tools.
   a. Initial setup tool.
   b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.

D. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye. The separate dimming control may be located in the appropriate relay cabint for these circuits.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
4. Light-Level Sensor Set-Point Adjustment Range: 20 to 100 fc (120 to 600 lux).

2.4 ROOM CONTROLLERS

A. Room Controllers are used to independently control lighting and switched receptacles.

B. Provide products that are compatible with Indoor Occupancy Sensors.

C. Digitally addressable room controller with the following functions.
1. Autonomous space control.
2. Networking to a central Dialog control system.
3. Networking to a central BACnet based management system.

D. The Room Controller shall consist of:
1. A universal voltage type (120Vac/277Vac/347Vac) power supply.
2. Four 20A rated relays complete with manual override. Circuit Load rating dependent on usage. One circuit dedicated for 20A receptacle control.
3. Four 0-10V control channels, capable of 100mA current sinking
4. A port to connect downstream switches, occupancy sensors and daylight sensors.
5. A port to connect upstream to BACnet IP building management system. The Controller shall communicate using native BACnet command objects appropriate for the application.
6. An indicating LED to aid in locating the controller in a darkened ceiling space.
7. Circuit testing buttons
8. Capable of connecting with WUL-3924
9. Output 24Vac 120mA
10. Relay Ratings
    a. 20A Suitable for General Purpose Loads @ 120/277 VAC
    b. 20A Suitable for Standard Ballasts and Tungsten Loads @ 120/277 VAC
    c. 16A Suitable for Electronic Ballasts @ 120/277 VAC
    d. 0.5HP @120/277 VAC.
11. The Room Controller relays shall be connected such that 120Vac plug load(s) and 277Vac lighting loads can be switched by a single Controller with no additional add-ons or remote modules
12. The Room Controller shall mount to electrical junction box via threaded ½” chase nipple. No other mounting hardware shall be required.
13. Switches shall connect to the lighting control network via a common low voltage, 2-wire, non-polarized data line.
    a. Switches shall be factory configured and programmed to control one or more outputs in the lighting control system.
    b. Switches can be programmed for preset control to set a specific lighting scene.
    c. Switches, with LED indicators to indicate both ON and OFF output/group status, shall be available with 2 or 4 single button switches per gang. Switch to fit standard Decora opening.
    d. Switches and switch hardware shall mount to standard wall boxes.
    e. Each switch shall provide a location for a label to identify function. The label shall be under a clear plastic cover and shall be field replaceable should the operation of the switch change. Permanently etched switches are not acceptable.
14. Dimmer switches shall be connected to the lighting control network via a common low voltage 2-wire, non-polarized data line.

a. Dimmer switches shall be capable of raising or lowering light levels of individual or groups of lighting fixtures.
b. Dimmer switches shall be capable of controlling across the full range of dimming settings within a period of three (3) seconds.

15. Space Control Requirements:
    a. Provide manual-on / auto-off control for lighting in all spaces that are controlled by a Room Controller.
    b. Provide auto-on / auto-off control for all switched receptacles that are controlled by a Room Controller.
    c. Provide auto-on / auto-off control for HVAC serving all spaces that contain a Room Controller. Control to be provided by either two-wire signal based on relay contact position or direct communication with the building management system using BACnet commands. Coordinate with building management system installer.
16. Shall have a built in dimmer memory, the light output will remain at the previous setting when the lights are turned off and back on.

2.5 INDOOR OCCUPANCY SENSORS

A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 260943, Relay Based Lighting Controls.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. In locations where the sensor or the local switch is/are marked “VS” the sensor shall turn the lights off automatically upon room vacancy. The lights shall turn on only upon activation from the associated wall station.
4. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
5. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
6. Mounting:
    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
7. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
8. Bypass Switch: Override the "on" function in case of sensor failure.
9. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using both PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.

2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
4. Remote powerpacks using one or more sensors shall be used to cover space as indicated on drawings.
5. Device shall be vacancy sensing (in conjunction with local wall station) if marked “VS”. Otherwise device shall be occupancy sensing.

2.6 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 260943, Relay Based Lighting Controls.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application,
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
3. Switch Rating: Not less than 800-VA LED at 120 V, 1200-VA LED loads at 277 V,

C. Wall-Switch Sensor:
1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft. (84 sq. m).
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP. SP, manual "on," automatic "off."
4. Voltage: Dual voltage, 120 and 277 V;
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
8. Device shall be Vacancy sensing if marked VS or occupancy sensing if not otherwise marked.

2.7 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Corporation.
4. GE Industrial Systems; Total Lighting Control.
5. Square D; a brand of Schneider Electric.

B. Description: Electrically operated, electrically held, combination-type lighting contactors with fusible switch complying with NEMA ICS 2 and UL 508.
   1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
   2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
   3. Enclosure: Comply with NEMA 250.
   4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

C. Interface with DDC System for HVAC: Provide hardware interface to enable the DDC system for HVAC to monitor and control lighting control systems and contactors.
   1. Monitoring: On-off status
   2. Control: On-off operation

2.8 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton (Cooper Controls), Inc.
   2. Lutron, Inc.
   3. Leviton Manufacturing Co., Inc.
   4. Philips Controls
   5. Acuity Controls
   6. NextLite
   7. Douglas Controls
   8. Wattstopper

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with automatic switching contacts; complying with UL 924.
   1. Coil Rating: as scheduled.

2.9 LOW-VOLTAGE CONTROLLERS

A. Low-Voltage Controllers are used to turn on and dim line voltage lighting safely when used with Nurse Call Pillow Speakers, Bed Side-Rail Controls and Momentary Dry Contact Switches.

B. Manufacturers: Subject to compliance with requirements, provide the following:
   1. Curbell Medical Products (Basis of Design is # LVC-2000-001)

C. Description: 3 Channel lighting controller to continuously dim 2 channels using 0-10 vdc signals to the dimming LED drivers for the ambient light and reading light channels in the luminaire and to switch one channel via the LED driver(s) for the exam light portion of the luminaire. Controller shall have control inputs from nurse call pillow speaker contacts and also be switched from wall switches as shown.

D. Installation: Lighting Controller shall be installed above the accessible ceiling outside the patient room for ease of access. All leads shall be extended from the switches, luminaire and nurse call system in an approved manner. Installer shall provide a NEMA 12 enclosure suitable for the purpose and mount the controller in this box. Observe required high and low voltage separation

and physical barriers. Label the cover with the words “LIGHTING CONTROLLER FOR ROOM ####”.

2.10 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 22 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified commissioning agent to evaluate lighting control devices and perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
   1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
   2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
   3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.7 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943 "Relay-Based Lighting Controls."

B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 26 09 36
STANDALONE MULTIPRESET MODULAR DIMMING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Wall-box multiscene dimming controls.
   2. Multipreset modular dimming controls.

1.3 DEFINITIONS

A. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.

B. Low Voltage: As defined in NFPA 70, the term for circuits and equipment operating at less than 50 V or for remote-control, signaling, and power-limited circuits.

C. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.

D. SCR: Silicon-controlled rectifier.

E. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For modular dimming controls; include elevation, dimensions, features, characteristics, ratings, and labels.
   2. Device plates and plate color and material.
   3. Ballasts and lamp combinations compatible with dimmers.

B. Shop Drawings:
   1. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For master- and remote-control stations, and faceplates with factory-applied color finishes and technical features.

D. Samples for Verification: For master- and remote-control stations, and faceplates with factory-applied color finishes and technical features.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the requirements of the specifications and contract documents provide products from one of the following manufactures:
   1. Lutron Electronics
   2. Crestron Electronics
   3. Leviton
   4. Cooper Controls
   5. Acuity Controls

2.2 GENERAL DIMMING DEVICE REQUIREMENTS

A. Compatibility:
   1. Dimming control components shall be compatible with lighting fixtures, ballasts, and transformers, including DALI or other addressable digitally controlled LED drivers.
   2. Dimming control devices shall be compatible with lighting control system components specified in Section 260943 "Relay-Based Lighting Controls," and in Section 260923 "Lighting Control Devices."

B. Dimmers and Dimmer Modules: Comply with UL 508.
   1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
   2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.
   3. Shall have a built in dimmer memory, the light output will remain at the previous setting when the lights are turned off and back on.

C. Surge Protection: Withstand supply power surges without impairment to performance.
   1. Panels: 6000 V, 3000 A, complying with IEEE C62.41.1 and IEEE C62.41.2.
   2. Other System Devices: 6000 V, 3000 A, complying with IEEE C62.41.1 and IEEE C62.41.2.

D. Off Control Position: User-selected off position of any control point shall disconnect the load from line supply.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

2.4 WALL-BOX MULTISCENE DIMMING CONTROLS

A. Description: Factory-fabricated equipment providing manual dimming consisting of a wall-box-mounted master controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in multigang wall box under a single wall plate. Each zone shall be adjustable to indicated number of scenes, which shall reside in the memory of zone controller.

B. Each zone shall be configurable to control the following loads:
   1. LED luminaires with electronic dimming drivers
   2. Incandescent lamp dimmers driving high capacity LED dimming power modules.

C. Dimmers: Regulate voltages to maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent rms.

D. Memory:
   1. Retain preset scenes and fade rates through momentary (up to 3-second) power interruptions.
   2. Retain preset scenes through power failures for at least seven days.

E. Device Plates: Style, material, and color shall comply with Section 262726 "Wiring Devices.". Master-control cover plate shall be one piece.

F. Master controller shall include the following:
   1. Cover-mounted switches, including master off, all bright, and selectors for each scene.
   2. Cover-mounted LED indicator lights, one associated with each scene switch, and one for the master off switch.
   3. Concealed switches and indicators for specified function.
   4. A raise/lower switch for each zone for temporary adjustments of the zone, without altering scene values stored in memory.
   5. Fade time indicated by digital display for current scene while fading.
   6. Cover-mounted infrared receiver.

G. Infrared Transmitters: Wireless remote control for recalling four of the presets. Operate up to 50 feet (15 m) within line of sight of the master controller.

2.5 CONDUCTORS AND CABLES

A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 24 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identifying components and power and control wiring.

B. Label each dimmer module with a unique designation.

C. Label each scene control button with approved scene description.

3.3 FIELD QUALITY CONTROL

A. Comply with commissioning requirements in specification section 019113 -General Commissioning Requirements, and specification section 260800 (BA2)

B. Testing Agency: Owner will engage a qualified commissioning agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Continuity tests of circuits.

2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
   a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

E. Remove and replace malfunctioning modular dimming control components and retest as specified above.

F. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

G. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain modular dimming controls. Laptop portable computer may be used in training.

B. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified and Section 260943 "Relay-Based Lighting Controls."

END OF SECTION

SECTION 26 09 43
RELAY-BASED LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Lighting control panels using mechanically held relays for switching with or without dimming modules.

B. Section Includes: Networked lighting control panels using control-voltage relays for switching and that are interoperable with DDC system for HVAC.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. IP: Internet protocol.

C. Dimming: a control signal generated by this panel that can control dimming properties of loads.

D. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

E. PC: Personal computer; sometimes plural as "PCs."

F. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

1.4 ACTION SUBMITTALS

A. Presubmittal meeting: Attend a coordination meeting to review all lighting control panels, control stations and control assignments prior to preparing submittal information.

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, relays, manual switches and plates, and conductors and cables.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Shop Drawings: For each relay panel and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail wiring partition configuration, current, and voltage ratings.
   4. Short-circuit current rating of relays.
   5. Include diagrams for power, signal, and control wiring.
   6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
   7. Communications Protocol: Indicate communications protocol and coordination of protocol with BMS and other systems requiring connection to lighting control system.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
   1. Show interconnecting signal and control wiring, and interface devices that prove compatibility of inputs and outputs.
   2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the network protocol.

B. Qualification Data: For testing agency.

C. Field quality-control reports.

D. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

E. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lighting Control Relays: Equal to 20 percent of amount installed, but no fewer than 24.

2. Lighting Control Dimming Modules: Equal to 10 percent of amount installed, but no fewer than 4.
3.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panels for installation according to NECA 407.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Input signal from field-mounted manual switches, or digital signal sources, shall open or close one or more lighting control relays in the lighting control panels. Any combination of inputs shall be programmable to any number of control relays.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with UL 916.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Lighting control panels shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   2. Component Importance Factor: 1.5.

B. Interface with DDC System for HVAC: Provide hardware and software to enable the DDC system for HVAC to monitor, control, display, and record data for use in processing reports.
   1. Hardwired Points:
      a. Monitoring: On-off status.
      b. Control: On-off operation.
   2. Communication Interface: Comply with ASHRAE 135. The communication interface shall enable the DDC system for HVAC operator to remotely control and monitor lighting from a DDC system for HVAC operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the DDC system for HVAC.

2.3 LIGHTING CONTROL RELAY PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton (Cooper Controls), Inc.
   2. Lutron, Inc.
   3. Leviton Manufacturing Co., Inc.
   4. Philips Controls
   5. Acuity Controls
   6. NextLite
   7. ETC
   8. Douglas Controls
   9. Watt Stopper

B. Description: Standalone lighting control panel using mechanically latched relays to control lighting and appliances.

C. Lighting Control Panel:
   1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, dimming modules and on-board timing and control unit.
   2. A vertical barrier separating branch circuits from control wiring.

D. Control Unit: Contain the power supply and electronic control for operating and monitoring individual relays.
   1. Timing Unit:
      a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
      b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
      c. Sixty four independent schedules, each having 24 time periods.
      d. Schedule periods settable to the minute.
      e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
      f. 10 special date periods.
   2. Sequencing Control with Override:
      a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
      b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
      c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
      d. Override control "blink warning" shall warn occupants approximately ten minutes before actuating the off sequence.
   3. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation, including accurate time of day and date.

E. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 120-V tungsten, 30 A at 277-V ballast, 1.5 hp at 120 V, and 3 hp at 277 V. Short-circuit current rating shall be not less than 14 kA. Control shall be three-wire, 24-V ac.

F. Power Supply: NFPA 70, Class 2, sized for connected equipment, plus 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of

the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and photo sensors.

G. Operator Interface:
1. Integral alphanumeric keypad and digital display, and intuitive drop-down menus to assist in programming.
2. Log and display relay on-time.
3. Connect relays to one or more time and sequencing schemes.

2.4 NETWORKED LIGHTING CONTROL PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton (Cooper Controls), Inc.
2. Lutron, Inc.
3. Leviton Manufacturing Co., Inc.
4. Philips Controls
5. Acuity Controls
6. NextLite
7. ETC
8. Douglas Controls
9. WattStopper

B. Description: Lighting control panels using mechanically latched relays to control lighting and appliances. The panels shall be capable of being interconnected with digital communications to appear to the operator as a single lighting control system. Panel shall also contain 0-10vdc dimming modules ad UL 924 listed emergency lighting section as shown on the drawings.

C. Lighting Control Panels:
1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, dimming modules and on-board timing and control unit.
2. A vertical barrier separating branch circuits from control wiring.
3. A horizontal barrier separating normal and life safety circuits.

D. Main Control Unit: Installed in the main lighting control panel only; powered from the branch circuit of the standard control unit.
1. Ethernet Communications: Comply with TCP/IP protocol. The main control unit shall provide for programming of all control functions of the main and all networked slave lighting control panels including timing, sequencing, and overriding.
2. Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications, and shall be able to communicate directly via DDC system for HVAC RS-485 serial networks and Ethernet 10Base-T networks as a native device and control 0-10vdc dimming circuits.
3. Web Server: Display information listed below over a standard Web-enabled server for displaying information over a standard browser.
   a. A secure, password-protected login screen for modifying operational parameters, accessible to authorized users via Web page interface.
   b. Panel summary showing the master and slave panels connected to the controller.
   c. Controller diagnostic information.
   d. Show front panel mimic screens for setting up controller parameters, input types, zones, and operating schedules. These mimic screens shall also allow direct breaker control and zone overrides.

4. Timing Unit:
   a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
   b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
   c. 64 independent schedules, each having 24 time periods.
   d. Schedule periods settable to the minute.
   e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
   f. 16 special date periods.
5. Time Synchronization: The timing unit shall be updated not less than every hour with the network time server.
6. Sequencing Control with Override:
   a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches or control stations.
   b. Sequencing control shall operate relays and dimmer modules one at a time or in groups, completing the operation of all connected relays in not more than 10 seconds.
   c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
   d. Override control "blinking warning" shall warn occupants approximately before actuating the off sequence.
   e. Controller shall operate the dimming modules in a preset mode, allowing full on, full off, high preset and low preset programming, with timed fades, (5 seconds to 2 minutes programmed fade transitions. These shall be indicated from the system clock or local manual control stations as shown on the drawings.
   f. System shall control dimmed or switched circuits located in indicated daylight control zones as programmed to be limited by the daylight harvesting controllers.
   g. System shall have inputs for manual control stations, occupancy sensors and daylight sensors as shown on the drawings.
   h. Activity log, storing previous relay operation, including the time and cause of the change of status.
   i. Download firmware to the latest version offered by manufacturer.

E. Standard Control Unit, installed in All Lighting Control Panels: Contain electronic controls for programming the operation of the relays in the control panel, contain the status of relays, and contain communications link to enable the digital functions of the main control unit. Comply with UL 916 and UL 924.
   1. Electronic control for operating and monitoring individual relays and dimmers, and display relay on-time.
   2. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation.
   3. Integral keypad and digital-display front panel for local setup, including the following:
      a. Blink notice, time adjustable from software.
      b. Ability to log and display relay on-time.
      c. Capability for accepting downloadable firmware so that the latest production features may be added in the future without replacing the module.
      d. Programming dimmed levels.

F. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 120-V tungsten, 30 A at 277-V ballast, 1.5 hp at 120 V, and 3 hp at 277 V. Short-circuit current rating shall be not less than 14 kA.

G. Dimming Modules: A control module that, in conjunction with a relay module, controls 0-10 vdc controllable LED drivers, 100 ma capacity. This is controllable from the relay control system and screens.

H. Power Supply: NFPA 70, Class 2, UL listed, sized for connected equipment, plus not less than 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and low-voltage photo sensors.

I. Operator Interface: At the main control unit, provide interface for a tethered connection of a portable PC running MS Windows for configuring all networked lighting control panels using setup software designed for the specified operating system. Include one portable device for initial programming of the system and training of Owner's personnel. That device shall remain the property of Owner.

J. Software:
1. Menu-driven data entry.
2. Online and offline programming and editing.
3. Provide for entry of the room or space designation for the load side of each dimmer or relay.
4. Monitor and control all relays, showing actual relay state and the name of the automatic actuating control, if any.
5. Size the software appropriate to the system.

2.5 MANUAL SWITCHES AND PLATES

A. Push-Button Switches: Modular, momentary contact, three wire, for operating one or more relays and to override automatic controls.
1. Match color and style specified in Section 262726 "Wiring Devices."
2. Integral green LED pilot light to indicate when circuit is on.
3. Internal white LED locator light to illuminate when circuit is off.
4. Internal red LED locator light to illuminate pushbutton selection on preset stations.

B. Wall Plates: Single and multigang plates as specified in Section 262726 "Wiring Devices."

C. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings or noted on submittal drawings.

2.6 FIELD-MOUNTED SIGNAL SOURCES

A. Daylight Harvesting Switching Controls: Comply with Section 260923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays and dimmers.

B. Indoor Occupancy Sensors: Comply with Section 260923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 24 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables. And compliant with manufacturer’s requirments"

C. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 6 for horizontal copper cable and with Section 271500 "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panels according to NECA 407.

B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install cables in raceways within wall and above inaccessible ceilings. Install cable in J-hooks above accessible ceilings. Conceal raceways and cables except in unfinished spaces.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 PANEL INSTALLATION

A. Comply with NECA 1.

B. Install panels and accessories according to NECA 407.

C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

E. Mount panel cabinet plumb and rigid without distortion of box.

F. Install filler plates in unused spaces.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.

D. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Comply with commissioning requirements in specification section 019113 -General Commissioning Requirements, and specification section 260800 (BA2)

B. Testing Agency: Owner will engage a qualified commissioning agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

E. Acceptance Testing Preparation:
   1. Test continuity of each circuit.

F. Lighting control panel will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.
   3. Verify proper operation of all daylight harvesting controls, all egress (emergency) lighting controls and local control stations.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 SOFTWARE SERVICE AGREEMENT

A. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within five years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

END OF SECTION

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Distribution, dry-type transformers rated 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
   2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
   3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For transformers, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control reports.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
2. General Electric Company.
3. Square-D Schneider Electric.
4. Siemens
5. Hammond Power Solutions

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. DOE 2016 – U.S. Department of Energy, Energy Conservation Program; Distribution Transformers Energy Conservation Standards DOE 10 CFR Part 431. Revised Apr.2013.

D. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

E. Coils: Continuous windings without splices except for taps.
1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper.

F. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.

G. Shipping Restraints: Paint or otherwise color code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Cores: One leg per phase.

D. Enclosure: Ventilated.
1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.

E. Transformer Enclosure Finish: Comply with NEMA 250.
1. Finish Color: Gray.

F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

H. Insulation Class, Smaller than 30 kVA: 185 deg C, UL-component-recognized insulation system with a maximum of 115-deg C rise above 40-deg C ambient temperature.

I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 115-deg C rise above 40-deg C ambient temperature.

J. K-Factor Rating: Transformers shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by K-factor equal to K-4.
1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.
3. Unit shall meet requirements of DOE 2016 when tested according to NEMA TP 2 with a K-factor equal to one.

K. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.

L. Neutral: Rated 200 percent of full load current for K-factor rated transformers.

M. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:
1. 9 kVA and Less: 40dBA.
2. 30 to 50 kVA: 45dBA.
3. 51 to 150 kVA: 50dBA.
4. 151 to 300 kVA: 55dBA.
5. 301 to 500 kVA: 60dBA.
6. 501 to 750 kVA: 62dBA.

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.
   1. Resistance measurements of all windings at the rated voltage connections and at all tap connections.
   2. Ratio tests at the rated voltage connections and at all tap connections.
   3. Phase relation and polarity tests at the rated voltage connections.
   4. No load losses, and excitation current and rated voltage at the rated voltage connections.
   5. Impedance and load losses at rated current and rated frequency at the rated voltage connections.
   6. Applied and induced tensile tests.
   7. Regulation and efficiency at rated load and voltage.
   8. Insulation Resistance Tests:
      a. High-voltage to ground.
      b. Low-voltage to ground.
      c. High-voltage to low-voltage.
   9. Temperature tests.

B. Factory Sound-Level Tests: Conduct prototype sound-level tests on production-line products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

B. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" or Section 033053 "Miscellaneous Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
   1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Secure transformer to concrete base according to manufacturer's written instructions.

D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

E. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS for dry-type, air-cooled, low-voltage transformers. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
   1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
   2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
   3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period after the building is fully occupied. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 23 13
LOW-VOLTAGE PARALLELING SWITCHGEAR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes metal-clad, low-voltage, circuit-breaker switchgear rated 1000 V and less, and associated control systems, for paralleling generators on an isolated bus and for distributing power in ac systems.

B. Related Sections include the following:
1. Division 26 Section "Electrical Power Monitoring and Control" for interfacing communication and metering requirements.
2. 019113 – GENERAL COMMISIONING REQUIREMENTS
3. 260800 – COMMISIONING ELECTRICAL SYSTEMS

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. GFCI: Ground-fault circuit interrupter.

C. HMI: Human machine interface.

1.4 SUBMITTALS

A. Product Data: For each type of switchgear and related equipment, include the following:

1. Technical data on features, performance, electrical characteristics, ratings, and finishes.
2. Rated capacities, operating characteristics, furnished specialties, and accessories for individual circuit breakers.
3. Features, characteristics, ratings, factory settings, and time-current characteristic curves for individual relays and overcurrent protective devices.
4. Description of sequence of operation for paralleling controls.

B. Shop Drawings: For each type of switchgear and related equipment, include the following:

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:

a. Tabulation of installed devices with features and ratings.
b. Enclosure types and details.
c. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.
d. Floor plan drawing showing locations for anchor bolts.
e. Bus configuration with current rating, size, and number of conductors in each bus run, including phase, neutral, and ground conductors of main and branch buses.
f. Short-time and short-circuit current rating of switchgear assembly.
g. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
h. Nameplate legends.
i. Mimic-bus diagram.
j. UL listing for series rating of installed devices.

2. Wiring Diagrams: For switchgear, paralleling control system, and related equipment, include the following:

a. Power, signal, and control wiring.
b. Schematic control diagrams.
c. Diagrams showing connections of component devices and equipment.
d. Three-line diagrams of current and future circuits showing device terminal numbers and internal diagrams.
e. Schematic diagrams showing connections to remote devices.

3. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting seismic restraints.

C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around switchgear where pipe and ducts are prohibited. Show switchgear layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

D. Samples: Representative portion of mimic bus with specified finish. Manufacturer's color charts showing colors available for mimic bus.

E. Manufacturer Seismic Qualification Certification: Submit certification that switchgear, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Qualification Data: For testing agency.

G. Source quality-control test reports.

H. Field quality-control test reports.

I. Updated mimic bus diagram reflecting field changes after final switchgear load connections have been made, for record.

J. Operation and Maintenance Data: For switchgear and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for sequence of operation.
2. Manufacturer's sample system checklists and log sheets.
3. Manufacturer's written instructions for testing and adjusting relays and overcurrent protective devices.
4. Time-current curves, including selectable ranges for each type of relay and overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Comply with commissioning requirements in specification section 019113 -General Commissioning Requirements, and specification section 260800

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

D. Source Limitations: Obtain switchgear through one source from a single manufacturer.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of switchgear and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Comply with NFPA 70.

H. Commissioning of the equipment's required for the contractor and vender per specification 019113

1.6 DELIVERY, STORAGE, AND HANDLING

A. in sections of lengths that can be moved past obstructions in delivery path.

B. Store switchgear indoors in clean dry space with uniform temperature to prevent condensation. Protect switchgear from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. If stored in areas subjected to weather, cover switchgear to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchgear; install electric heating (250 W per section) to prevent condensation.

1.7 PROJECT CONDITIONS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchgear, including clearances between switchgear and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Environmental Limitations: Rate equipment for continuous operation at indicated ampere ratings for the following conditions:

1. Ambient temperature not exceeding 104 deg F (40 deg C).
2. Altitude of 7,000 feet above sea level.

1.8 COORDINATION

A. Coordinate layout and installation of switchgear and components with other construction that penetrates ceilings or is supported by them, including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.

B. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Six of each type and rating used. Include spares for control power circuits and fusible devices.
2. Indicating Lights: Six of each type installed.

B. Maintenance Tools: Furnish tools and miscellaneous items required for switchgear test, inspection, maintenance, and operation. Include the following:

1. Floor-running transport or dockable dolly with manual lifting mechanism and all other items necessary to remove circuit breaker from housing and transport to remote location.
2. Racking handle to move circuit breaker manually between connected and disconnected positions, and a secondary test coupler to permit testing of circuit breaker without removal from switchgear.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion or 1,500 hours (Include parts, labor and travel).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GENERATOR PARALLELING MONITOR AND CONTROL SYSTEM

A. Manufacturers:
1. Emerson; ASCO Power Technologies, LP.
2. Onan Corp.; Cummins Inc.; Industrial Business Group.(BA1)

B. Control and Monitoring Panel: Provide each generator with a control and monitoring panel that allows the operator to view status and control operation of respective generator. Provide panel with the following features and characteristics:

1. Generator Metering: 1 percent accuracy class or better.

a. Ammeter, Voltmeter, Frequency Meter, Wattmeter, Kilowatt-Hour Meter, and Power Factor Meter:

1) For three-phase and four-wire systems, indicate line-to-line and line-to-neutral conditions on voltmeter.

2) Provide switches or other provisions to allow reading of both generator and bus voltages and frequencies from this metering set.

b. Digital Meter is numerically displayed on PCC.

2. Generator Protective and Control Switches: Provide oiltight, industrial-grade switches in generator control and monitoring panel.

a. Mode Selector Switch (Run/Off/Auto):

1) "Run" mode to start and accelerate unit to rated speed and voltage, but not close paralleling circuit breaker.
2) "Off" mode to prevent generator from starting or to immediately shutdown generator if running.
3) "Auto" mode to allow generator to start on receipt of remote start signal.

b. Circuit-Breaker Trip/Close Switch: Interlocked with system control so that circuit-breaker closure is impossible unless the following occurs:

1) Mode selector switch is in "Run" position.
2) Generator set is synchronized with system bus.

c. Control/reset push button with flashing lamp to indicate generator is locked out due to fault condition.
d. Lamp test push button to simultaneously test all lamps on panel.
e. Control Panel Illumination: DC lamps to illuminate panel when lighting from surrounding environment is not available.
f. Emergency Stop Push Button: Red mushroom-head switch maintaining its position until manually reset.
g. Voltage and Frequency Raise/Lower Switches:

1) Allow plus/minus 5 percent adjustment when generator set is operating but not paralleled.

3. Generator Protective and Control Devices: Solid-state industrial relays, integrated microprocessor-based control devices, and other accessories and devices located either in generator control and monitoring panel or in switchgear control section to provide the following features and functions:

a. Kilowatt Load Sharing Control:

1) Operates engine governors during synchronizing and provides isochronous load sharing when paralleled.
2) Allows generator set to ramp up to kilowatt load level signaled by system master controller.

b. Load-Demand Governing Control:

1) Causes generator set to ramp down to zero load when signaled to shut down in load-demand mode.
2) Causes generator set to ramp up to a proportional share of total bus load.

c. Kilovolt Ampere Rating Load Sharing Control:

1) Operates alternator excitation system while generator set is paralleled.
2) Causes sharing of reactive load among all generator sets to within 1 percent of equal levels without voltage drop.

d. Sync-Check and Paralleling Monitor and Control:

1) Monitors and verifies that generator set has reached 90 percent of nominal voltage and frequency before closing to bus.
2) Prevents out-of-phase paralleling if two or more generator sets reach operating conditions simultaneously, by sending "inhibit" signal to sets not designated by system as "first to close to bus."
3) Recognizes failure of "first-to-close" generator set and signals system paralleling to continue.
4) Prevents out-of-phase closure to bus due to errant manual or automatic operation of synchronizer.

e. Synchronizer Control:

1) Adjusts engine governor to match voltage, frequency, and phase angle of paralleling bus.
2) Maintains generator-set voltage within 1 percent of bus voltage, and phase angle within 20 electrical degrees of paralleling bus for 0.5 seconds before circuit-breaker closing.
3) Provides "fail-to-synchronize time delay" adjustable from 10 to 120 seconds; with field selectivity to either initiate alarm or shut down generator set on failure condition.

f. Reverse Power Monitor and Control:

1) Prevents sustained reverse power flow in generator set.
2) Trips generator circuit breaker and initiates generator set shutdown when reverse power condition exceeds 10 percent of generator set kilowatt for three seconds.

g. Phase Rotation Monitor and Control:

1) Verifies generator set and paralleling bus phase rotation match prior to closing paralleling circuit breaker.

h. Electronic Alternator Overcurrent Alarm and Shutdown Control:

1) Monitors current flow at generator-set output terminals.
2) Initiates alarm when load current on generator set is more than 110 percent of rated current for more than 60 seconds.
3) Provides overcurrent shutdown function matched to thermal damage curve of alternator. Provide without instantaneous-trip function.

i. Electronic Alternator Short-Circuit Protection:

1) Provides shutdown when load current is more than 175 percent of rated current and combined time/current approaches thermal damage curve of alternator. Provide without instantaneous-trip function.

j. Loss of Excitation Monitor:

1) Initiates alarm when sensing loss of excitation to alternator while paralleled to system bus.

k. Generator-Set Start Contacts: Redundant system, 10 A at 32-V dc.
l. Cool-Down Time-Delay Control: Adjustable, 0 to 600 seconds.
m. Start Time-Delay Control: Adjustable, 0 to 300 seconds.
n. Paralleling Circuit-Breaker Monitor and Control:

1) Monitors circuit-breaker auxiliary contacts.
2) Initiates fault signal if circuit breaker fails to close within adjustable time-delay period (0.5 to 15 seconds).
3) Trips open and locks out paralleling circuit breaker upon paralleling circuit breaker failure to close, until manually reset.

1. Alternate Maintenance Setting (AMS) switch Design for the temporary arc-flash incident energy reduction during maintenance activities.

a. For each feeder circuit breaker, provide a manual switch on the compartment door to switch the circuit breaker short time tripping characteristics to instantaneous with minimum pick-up setting, in order to reduce the danger from potential arc-flash at downstream equipment.

b. Provide a lock feature for the AMS switch so that it may be locked in either the Off or On maintenance mode position.

c. Provide a blue LED indicating light to indicate AMS switch is in the maintenance mode.

d. Wire contacts on all AMS switches to a common alarm input to plant control system.

e. Provide for remote AMS switches or indication, as needed.

f. If circuit breaker integral trip unit cannot be controlled as specified, provide discrete relay with shunt-trip or equivalent to provide specified performance.

4. Alternate Maintenance Setting (AMS) switch Design for the temporary arc-flash incident energy reduction during maintenance activities.
a. For each feeder circuit breaker, provide a manual switch on the compartment door to switch the circuit breaker short time tripping characteristics to instantaneous with minimum pick-up setting, in order to reduce the danger from potential arc-flash at downstream equipment.
b. Provide a lock feature for the AMS switch so that it may be locked in either the Off or On maintenance mode position.
c. Provide a blue LED indicating light to indicate AMS switch is in the maintenance mode
d. Wire contacts on al AMS switches to a common alarm input to plant control system.
e. Provide remote AMS switches or indication, as needed.

5. Engine Protection and Local Annunciation:

a. Annunciations are displayed on the DMC HMI
b. Annunciate the following conditions:

1) Status, Light Only (Nonlatching):

a) Generator engine control switch not in auto (red).
b) Generator engine control switch in auto (green).
c) Emergency mode (red).
d) Generator circuit breaker closed (red).
e) Generator circuit breaker open (green).
f) Engine stopped (green).
g) Engine running (red).
h) Engine cool-down (amber).

2) Pre-Alarm, Light and Horn (Nonlatching):

a) Pre-high coolant temperature (amber).
b) Pre-low oil pressure (amber).
c) Low coolant temperature (amber).
d) Engine low battery (amber).
e) Engine low fuel (amber).
f) Generator fails to synchronize (amber).

3) Shutdown Alarm, Light and Horn (Latching):

a) Engine overcrank (red).
b) Engine overspeed (red).
c) Engine low oil pressure (red).
d) Engine high coolant temperature (red).
e) Engine low coolant level (red).
f) Engine remote emergency shutdown (red).
g) Generator circuit breaker tripped (red).
h) Generator loss of field (red).
i) Generator reverse power (red).
j) Generator undervoltage (red).
k) Generator overvoltage (red).
l) Generator underfrequency (red).
m) Generator overfrequency (red).

C. Master Control System and Monitoring Equipment: Paralleling and monitoring equipment, components, and accessories for multiple generators with the following features and characteristics:

1. Components and devices shall be mounted in the switchgear control section of the switchgear lineup.
2. Paralleled System Metering: 1 percent accuracy class or better to monitor total output of generator bus.

a. Ammeter, voltmeter, frequency meter, wattmeter, kilowatt-hour meter, power factor meter, kilovolt ampere, kilovolt ampere rating, and kilowatt demand meters.

1) For three-phase/four-wire systems, indicate line-to-line and line-to-neutral conditions on voltmeter.
2) Display all functions on the HMI device.

3. Full-Color HMI Device: Touchscreen with minimum viewing area of 146 square inches.

a. Allows operator to monitor and control the complete system of paralleled generator sets.
b. Screens shall include the following:

1) Main Menu: Include date, time, and system status messages with screen push buttons to access one-line diagram, system controls, load controls, alarms, bus metering, and individual generator-set data.
2) One-Line Diagram Screen: Depicting system configuration and system status by screen animation, screen colors, text messages, or pop-up indicators. Indicate the following minimum system conditions:

a) Generator sets, buses, and paralleling circuit breakers energized/de-energized.
b) Generator-set mode (run/off/auto).
c) Generator-set status (normal/warning/shutdown/load-demand stop).
d) Paralleling circuit-breaker status (open/closed/tripped).
e) Bus conditions (energized/de-energized).
f) Provide access to other screens.

3) AC Metering Screen: Displays the following minimum meter data for the paralleling bus:

a) Phase volts and amperes, kilowatt, kilovolt ampere, kilovolt ampere rating, power factor, frequency, kilowatt hour, and kilowatt demand.
b) Real-time trend chart for system kilowatts and volts updated on not less than one-second intervals.
c) A minimum of one historical trend chart for total system loads with intervals no shorter than five minutes and a minimum duration of four hours.

4) Generator-Set Control Screen provided on the DMC HMI: Provides control over individual generator sets from master system control panel. Includes the following minimum functions:

a) Generator manual start/stop control (functional only when generator-set mounted control switch is in "Auto" position).
b) Generator-set alarm reset.
c) Manual paralleling and circuit-breaker controls.

5) Generator-Set Data Display Screen: Provide the following minimum parameters:

a) Engine speed, oil pressure and temperature, coolant temperature, and engine operating hours.
b) Three-phase voltage and current, kilowatt, power factor, and kilowatt hour.
c) Generator control switch position and paralleling circuit-breaker position.
d) All generator-set alarms.

6) System Control Screen: Password protected and with the following minimum functions:

a) System Test Modes: Test with load/test without load/normal/retransfer time-delay override.
b) Test with Load: Starts and synchronizes generator sets on paralleling bus; all loads are transferred to bus.
c) Test without Load: Starts and synchronizes generator sets on paralleling bus but does not transfer loads to bus.
d) Time adjustments for retransfer time delay, transfer time delay, system time delay on stopping, and system time delay on starting.

7) Load-Demand Control Screen: Monitors total load on system bus and controls number of generator sets running so that capacity tracks load demand.

a) Load-Demand Control: On/off.
b) Load-Demand Pickup Set Point: Adjustable from 90 to 40 percent in 5 percent increments.
c) Load-Demand Dropout Set Point: Adjustable from 20 to 70 percent in 5 percent increments.

8) Manual Load Control Screen: Allows operator to manually add or delete generator sets from paralleled system in response to system load parameters.

a) Indication of system available in kilowatts and amperes.
b) Control functions allow manual addition/removal of generator sets on system, and activation of load-shed/load-restore functions.

9) Load-Add/Load-Shed Sequence Screen: Password protected and with the following minimum functions:

a) Assigns "load-add sequence priority" to each load control relay with designation for relay operation after a set number of generator sets are online.
b) Assigns "load-shed sequence priority" to each load control relay with designation for relay operation depending on number of generator sets online.

10) Alarm Summary and Run Report Screen:

a) Lists most recent alarm conditions and status changes.
b) Lists a minimum of the most recent 32 alarm conditions by name and time/date; acknowledges alarm conditions with time/date.
c) For each start signal, lists start time and date, stop time and date, maximum kilowatt and ampere load on system during run time, and start and stop times of individual generator sets.

4. Solid-State System Status Panel:

a. Provides visual alarm status indicator and alarm horn with silence/acknowledge push button.
b. Annunciates the following conditions:

1) Status, Light Only:

a) Running Status: Display generator set number and "green" running-status light.
b) Load demand mode (green).
c) Priority Load Status: Display load number and "green" on-status light.
d) System test (green).
e) Remote system start (red).
f) Normal source available (green).
g) Connected to normal (green).
h) Generator source available (green).
i) Connected to generator source (green).

2) Status, Light and Alarm:

a) Load-Shed Level Status: Displays load number and red load-shed, status light.
b) Generator Alarm Status: Displays generator number and red "Check Generator" status light.
c) Controller malfunction (red).
d) Check station battery (red).
e) Bus overload (red).
f) System not in auto (red).

D. Description of System Operation:

1. Loss of Normal Power:

a. System receives "start" signal; all generator sets start and achieve rated voltage and frequency.
b. System closes the first generator set achieving 90 percent of rated voltage to paralleling bus.
c. "Priority load add" controls prevent overloading of system.
d. Remaining generator sets switched to synchronizers that control and then allow closure of generator sets to paralleling bus.
e. On closure to paralleling bus, each generator set assumes its proportional share of total load.

2. Failure of a Generator Set to Start or Synchronize:

a. After expiration of overcrank time delay, generator set shuts down and alarm is initiated.
b. Priority controller prevents overload of system bus.
c. Manual override of priority controller at HMI allows addition of low-priority load to bus.
d. Bus overload monitor protects bus from manual overloading.

3. Bus Overload:

a. On bus overload, load-shed control initiates load shedding.
b. If bus does not return to normal frequency within adjustable time period, additional load continues to be shed until bus returns to normal frequency.
c. Loads shed can be reconnected to bus only by manual reset at HMI.

4. Load-Demand Mode:

a. With "load-demand" function activated, controller continuously monitors total bus load.
b. If bus load is below preset limits for 15 minutes, demand controller shuts down generator sets in predetermined order until minimum number of sets are operating.
c. On sensing available bus capacity diminished to set point, controller starts and closes generator sets to bus to accommodate load.

5. Return to Normal Power:

a. Process starts on removal of start signals from system.
b. When no load remains on paralleling bus, all generator breakers open, go through cool-down period, and shut down.
c. If start signal is received during cool-down period, one generator set is reconnected to bus, and system operation follows that of "loss of normal power."

6. Load Bank Operation Sequence when connected to Genbus – System is designed such that the load bank breaker is a regular breaker on the paralleling bus (similar to a normal feeder breaker). This breaker can be a dual-purpose breaker which can be connected to a temporary generator. LB/TG can be configured on the Setup page of the HMI.
   a. Load Bank Test On
      1) On the HMI, navigate to the load bank control screen
      2) Enable the “Load Bank Control Module”
      3) Select the Generator set to be controlled from the dropdown menu. Open the control fly out.
      4) Press the “Generator Start” button to start the selected generator set.
      5) Press the “Generator CB Close” button to close the selected Genset Breaker.
      6) Additional Generator set can be started and brought online by selecting it from the dropdown menu.
      7) Once a least one generator set I online, press the “load bank CB clos” button to close the load ban breaker (2-LB/TG)
         a) Note: If utility fails during load bank operation, “Load Bank Control Mode” will be cancelled, the Load Bank breaker will open, and the system will respond to normal source failure as described in Normal source failure section.
         b) Note: If the PLC fails, the PLC malfunction Relay in the DMC will be used to trip the 52-LB/TG breaker, and will prevent it from reclosing until the PLC is operational again

   b. Load Bank Test Off
      1) To end load bank test operation, disable the “load Bank Control Mode”
      2) The Load Bank Breaker will open
      3) The Generator set paralleling breaker(s) will open
      4) The generator set(s) will enter the cool down mode.
      5) The system returns to standby mode of operation

2.3 MANUFACTURED UNITS

A. Description: Factory assembled and tested and complying UL 891

B. Ratings: Suitable for application in 3-phase, 60-Hz, solidly grounded neutral system.

C. Indoor Enclosure Material: Steel.

D. Access: Fabricate enclosure with hinged, rear cover panels to allow access to rear interior of switchgear.

E. Finish: Manufacturer's standard gray finish over a rust-inhibiting primer on phosphatizing-treated metal surfaces.

F. Phase-, Neutral-, and Ground-Bus Materials: Extend full length of switchgear.

1. Phase Bus: Copper, tin plated.
2. Ground Bus: Copper, tin plated; minimum size 1/4 by 2 inches (6 by 50 mm).

G. Switchgear Components: Incorporate components as indicated on Drawings.

1. Instrument Transformers: Comply with IEEE C57.13.

a. Potential Transformers: Secondary-voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
b. Current Transformers: Burden and accuracy class suitable for connected relays, meters, and instruments.

2. Comply with NEC 2014 Arch Maintenance switches and TVSS requirements.

3. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems, listed and labeled by UL, and with the following features:

a. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
b. Switch-selectable digital display with the following features:

1) Phase Currents, Each Phase: Plus or minus 1 percent.
2) Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
3) Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
4) Three-Phase Real Power: Plus or minus 2 percent.
5) Three-Phase Reactive Power: Plus or minus 2 percent.
6) Power Factor: Plus or minus 2 percent.
7) Frequency: Plus or minus 0.5 percent.
8) Integrated Demand, with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
9) Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.

c. Communications module suitable for remote monitoring of meter quantities and functions. Interface communication and metering requirements according to Division 26 Section "Electrical Power Monitoring and Control."
d. Mounting: Display and control unit that is flush or semiflush mounted in instrument compartment door.

4. Provision for Future Devices: Equip compartments with rails, mounting brackets, supports, necessary appurtenances, and bus connections.
5. Provide remote HMI
6. Provide Hot Standby PLC
7. Control Power Supply: Provide a separate freestanding control power battery system supplying 24 vdc for equipment with secondary redundant supply derived from Genset battery system.

a. Dry-type transformers, in separate compartments for units larger than 3 kVA, including primary and secondary fuses.
b. Two control power transformers in separate compartments with necessary interlocking relays; each transformer connected to line side of associated main circuit breaker.

1) Secondary windings connected through relay(s) to control bus to effect an automatic transfer scheme.
2) Secondary windings connected through an internal automatic transfer switch to switchgear control power bus.

c. Control Power Fuses: Primary and secondary fuses provide current-limiting and overload protection.
d. Fuses are specified in Division 26 Section "Fuses."

8. Control Wiring: Factory installed, complete with bundling, lacing, and protection; and complying with the following:

a. Flexible conductors for No. 8 AWG and smaller, for conductors across hinges and for conductors for interconnections between shipping units.
b. Conductors sized according to NFPA 70 for duty required.

H. Identification: Electrical identification devices and installation requirements are specified in Division 26 Section "Identification for Electrical Systems."

1. Identify units, devices, controls, and wiring.
2. Mimic Bus: Continuous mimic bus, applied to front of switchgear, arranged in one-line diagram format, using symbols and lettered designations consistent with approved mimic-bus diagram.

a. Mimic-bus segments coordinated with devices in switchgear sections to which applied, to produce a concise visual presentation of principal switchgear components and connections.
b. Medium: Painted graphics, as selected by Architect.
c. Color: Contrasting with factory-finish background; as selected by Architect from manufacturer's full range.

I. Control Battery System:

1. System Requirements: Battery shall have number of cells and ampere-hour capacity based on an initial specific gravity of 1.210 at 25 deg C with electrolyte at normal level and minimum ambient temperature of 13 deg C. Cycle battery before shipment to guarantee rated capacity on installation. Arrange battery to operate ungrounded.
2. Battery: Lead-calcium type in sealed, clear plastic or glass containers, complete with electrolyte, fully charged, and arranged for shipment with electrolyte in cells. Limit weight of each container to not more than 70 lb (32 kg) and cells per container to not more than 3. System batteries shall be suitable for service at an ambient temperature ranging from minus 18 to 25 deg C. Limit variation of current output to 0.8 percent for each degree below 25 deg C down to minus 8 deg C.
3. Rack: Two-step rack with electrical connections between battery cells and between rows of cells; include two flexible connectors with bolted-type terminals for output leads. Rate battery rack, cell supports, and anchorage for seismic requirements.
4. Accessories:

a. Thermometers with specific-gravity correction scales.
b. Hydrometer syringes.
c. Set of socket wrenches and other tools required for battery maintenance.
d. Wall-mounting, nonmetallic storage rack fitted to store above items.
e. Set of cell numerals.

5. Charger: Static-type silicon rectifier equipped with automatic regulation and provision for manual and automatic adjustment of charging rate. Unit shall automatically maintain output voltage within 0.5 percent from no load to rated charger output current, with ac input-voltage variation of plus or minus 10 percent and input-frequency variation of plus or minus 3 Hz. Other features of charger include the following:

a. DC ammeter.
b. DC Voltmeter: Maximum error of 5 percent at full-charge voltage; operates with toggle switch to select between battery and charger voltages.
c. Ground Indication: Two appropriately labeled lights to indicate circuit ground, connected in series between negative and positive terminals, and with midpoint junction connected to ground by normally open push-button contact.
d. Capacity: Sufficient to supply steady load, float-charge battery between 2.20 and 2.25 V per cell and equalizing charge at 2.33 V per cell.
e. Charging-Rate Switch: Manually operated switch provides for transferring to higher charging rate. Charger operates automatically after switch operation until manually reset.
f. AC power supply is 120 V, 60 Hz, subject to plus or minus 10 percent variation in voltage and plus or minus 3-Hz variation in frequency. After loss of ac power supply for any interval, charger automatically resumes charging battery. Charger regulates rate of charge to prevent damage due to overload and to prevent fuses or circuit breakers from opening.
g. Protective Feature: Current-limiting device or circuit, which limits output current to rating of charger but does not disconnect charger from either battery or ac supply; protects charger from damage due to overload, including short circuit on output terminals.
h. Electrical Filtering: Reduces charger's audible noise to less than 26 dB.

2.4 METAL-CLAD, CIRCUIT-BREAKER SWITCHGEAR (1000 V AND LESS)

A. Description: Factory assembled and tested, and complying with IEEE C37.20.1.

B. Nominal System Voltage: 480/277 V, 4 wire, 60 Hz.

C. Main-Bus Continuous: 5000 A.

D. Integrated TVSS rated at 240kA

E. Short-Time and Short-Circuit Current: Match rating of highest-rated circuit breaker in switchgear assembly.

F. Switchgear Fabrication:

1. Bus isolation barriers shall be arranged to isolate line bus from load bus at each main and tie circuit breaker.

2. Circuit-breaker compartments shall be equipped to house drawout-type circuit breakers and shall be fitted with hinged outer doors.
3. Auxiliary Compartments: Match and align with basic switchgear assembly. Include the following:
   a. Hinged front panels for access to accessory and blank compartments.

4. Bus bars connect between vertical sections and between compartments. Cable connections are not permitted.

   a. Main Phase Bus: Uniform capacity the entire length of assembly.
   b. Neutral Bus: 100 percent of phase-bus ampacity, except as indicated. Equip bus with pressure-connector terminations for outgoing neutral conductors.
   c. Vertical Section Bus Size: Comply with IEEE C37.20.1, including allowance for spare circuit breakers and spaces for future circuit breakers.
   d. Supports and Bracing for Buses: Adequate strength for indicated short-circuit currents.
   e. Neutral Disconnect Link: Bolted, uninsulated, 1/4-by-2-inch (6-by-50-mm) copper bus, arranged to connect neutral bus to ground bus.
   f. Provide for future extensions from either end of main phase, neutral, and ground bus by means of predrilled bolt-holes and connecting links.
   g. Bus-Bar Insulation: Individual bus bars wrapped with factory-applied, flame-retardant tape or spray-applied, flame-retardant insulation.

      1) Sprayed Insulation Thickness: 3 mils (0.08 mm), minimum.
      2) Bolted Bus Joints: Insulate with secure joint covers that can easily be removed and reinstalled.

5. Circuit-Breaker Terminals for Cable Connections: Silver-plated copper bus extensions equipped with pressure connectors for conductors.

G. Circuit Breakers: Comply with IEEE C37.13.

1. Ratings: As indicated for continuous, interrupting, and short-time current ratings for each circuit breaker; voltage and frequency ratings same as switchgear.
2. Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with the following features:

   a. Normal Closing Speed: Independent of both control and operator.
   b. Slow Closing Speed: Optional with operator for inspection and adjustment.
   c. Stored-Energy Mechanism: Electrically charged, with optional manual charging.
   d. Operation counter.

3. Trip Devices: Solid-state, overcurrent trip-device system consisting of one or two current transformers or sensors per phase, a release mechanism, and the following features:

   a. Functions: Long-time-delay, short-time-delay, and instantaneous-trip functions, independent of each other in both action and adjustment.
   b. Temperature Compensation: Ensures accuracy and calibration stability from minus 5 to plus 40 deg C.
   c. Field-adjustable, time-current characteristics.
   d. Current Adjustability: Dial settings and rating plugs on trip units or sensors on circuit breakers, or a combination of these methods.

e. Three bands, minimum, for long-time- and short-time-delay functions; marked "minimum," "intermediate," and "maximum."
f. Pickup Points: Five minimum, for long-time- and short-time-trip functions. Equip short-time-trip function for switchable I^2t operation.
g. Pickup Points: Five minimum, for instantaneous-trip functions.
h. Ground-fault protection with at least three short-time-delay settings and three trip-time-delay bands; adjustable current pickup. Arrange to provide protection for the following:

1) Three-wire circuit or system.
2) Four-wire circuit or system.
3) Four-wire, double-ended substation.

i. Trip Indication: Labeled, battery-powered lights or mechanical targets on trip device to indicate type of fault.

4. Auxiliary Contacts: For interlocking or remote indication of circuit-breaker position, with spare auxiliary switches and other auxiliary switches required for normal circuit-breaker operation, quantity as indicated. Each consists of two Type "a" and two Type "b" stages (contacts) wired through secondary disconnect devices to a terminal block in stationary housing.
5. Drawout Features: Circuit-breaker mounting assembly equipped with a racking mechanism to position circuit breaker and hold it rigidly in connected, test, and disconnected positions. Include the following features:

a. Interlocks: Prevent movement of circuit breaker to or from connected position when it is closed.
b. Circuit-Breaker Positioning: An open circuit breaker may be racked to or from connected, test, and disconnected positions only with the associated compartment door closed, unless live parts are covered by a full dead-front shield. An open circuit breaker may be manually withdrawn to a position for removal from the structure with the door open. Status for connection devices for different positions includes the following:

1) Test Position: Primary disconnect devices disengaged, and secondary disconnect devices and ground contact engaged.
2) Disconnected Position: Primary and secondary devices and ground contact disengaged.

6. Arc Chutes: Readily removable from associated circuit breaker when it is in disconnected position; arranged to permit inspection of contacts without removing circuit breaker from switchgear.
7. Padlocking Provisions: For installing at least three padlocks on each circuit breaker to secure its enclosure and prevent movement of drawout mechanism.
8. Operating Handle: One for each circuit breaker capable of manual operation.
9. Electric Close Button: One for each electrically operated circuit breaker.
10. Mechanical Interlocking of Circuit Breakers: Uses a mechanical tripping lever or equivalent design and electrical interlocks.
11. Undervoltage Trip Devices: Instantaneous, with adjustable pickup voltage.
12. Undervoltage Trip Devices: Adjustable time-delay and pickup voltage.
13. Shunt-Trip Devices: Where indicated.
14. Indicating Lights: To indicate circuit breaker is open or closed, for main and bus tie circuit breakers interlocked either with each other or with external devices.

H. Accessories: Furnish tools and miscellaneous items required for circuit-breaker and switchgear tests, inspections, maintenance, and operation.

1. Racking handle to manually move circuit breaker between connected and disconnected positions.
2. Portable test set for testing all functions of circuit-breaker, solid-state trip devices without removal from switchgear.
3. Relay and meter test plugs suitable for testing switchgear meters and switchgear class relays.

I. Circuit-Breaker Removal Apparatus: Portable, floor-supported, roller-base, elevating carriage arranged for moving circuit breakers in and out of compartments.

J. Circuit-Breaker Removal Apparatus: Overhead-circuit-breaker lifting device, track mounted at top front of switchgear and complete with hoist and lifting yokes matching each size of drawout circuit breaker installed.

K. Spare-Fuse Cabinet: Identified and compartmented steel box or cabinet with lockable door.

L. Storage for Manual: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

2.5 INSTALLATION

A. Comply with applicable portions in NECA 400.

B. Anchor switchgear assembly to 4-inch (100-mm) channel-iron embedded in concrete base and attach by bolting.

1. Sills: Select to suit switchgear; level and grout flush into concrete base.
2. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems" for seismic-restraint requirements.
3. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of switchgear, unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, brackets, and temporary blocking of moving parts from switchgear units and components.

2.6 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

B. Diagrams and Instructions:

1. Frame and mount under clear acrylic plastic on front of switchgear.

a. Operating Instructions: Printed basic instructions for switchgear, including control and key-interlock sequences and emergency procedures.
b. System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads.

2. Storage for Maintenance: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

2.7 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Cable terminations at switchgear are specified in Division 26 Section "Medium-Voltage Cables."

2.8 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect switchgear installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.
2. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 26 Sections.
3. Complete installation and startup checks according to manufacturer's written instructions.
4. Assist in field testing of equipment including pretesting and adjusting of equipment and components.
5. Report results in writing

C. Field testing for switch gear will include both contractor and vendor technician time for an integrated systems test and pull the plug test.

D. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

E. Perform the following field tests and inspections and prepare test reports:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:

a. Switchgear.
b. Circuit breakers.
c. Instrument transformers.
d. Metering and instrumentation.
e. Ground-fault systems.
f. Surge arresters.

2. Remove and replace malfunctioning units and retest as specified above.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchgear. Remove front and rear panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchgear 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switchgear checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

2.9 ADJUSTING

A. Set field-adjustable, protective-relay trip characteristics according to results in Division 26 Section "Overcurrent Protective Device Coordination Study."

B. Set field-adjustable, protective-relay trip characteristics.

2.10 CLEANING

A. On completion of installation, inspect interior and exterior of switchgear. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair damaged finishes.

2.11 PROTECTION

A. Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturers stipulated service conditions.

2.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchgear. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 26 24 13
SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Service and distribution switchboards rated 600 V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Accessory components and features.
6. Identification.

1.3 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.
1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.
1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of NRTL listing for series rating of installed devices.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include schematic and wiring diagrams for power, signal, and control wiring.
11. Include locations of infrared scanning windows on switchboard elevations

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For switchboards, overcurrent protective devices, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field Quality-Control Reports:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Routine maintenance requirements for switchboards and all installed components.
      b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
      c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Comply with commissioning requirements in specification section 019113 -General Commissioning Requirements, and specification section 260800 (BA2)

B. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

C. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation if switchboards are installed in unconditioned space.

C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.8 FIELD CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:
1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
   b. Altitude: Not exceeding 4,549 feet (1,387 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Owner no fewer than fourteen days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Three years from date of Substantial Completion.

B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
   2. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 SWITCHBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton.
   2. General Electric Company.
   3. Siemens Power Transmission & Distribution, Inc.
   4. Square D; by Schneider Electric.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 2.

F. Comply with NFPA 70.

G. Comply with UL 891.

H. Front-Connected, Front-Accessible Switchboards:
   1. Main Devices: Fixed, individually mounted.
   2. Branch Devices: Panel mounted.
   3. Sections front and rear aligned.

I. Nominal System Voltage: 480Y/277 V and 208Y/120 V as indicated on drawings.

J. Main-Bus Continuous: 4000A, 2000A, or 1600 A as indicated on drawings.

K. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

L. Indoor Enclosures: Steel, NEMA 250, Type 1.

M. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

N. Outdoor Enclosures: Type 3R.
   1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.
   2. Enclosure: Downward, rearward sloping roof; bolt-on rear covers with handles for each section
   3. Doors: hinged and lockable with owner supplied padlock. Allow access to circuit breaker and metering.
   4. 1.5H corrosion resistant base channels.
   5. Rodent Barriers
   6. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.
      a. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
      b. Space-Heater Power Source: 120-V external branch circuit.

O. Pull Box on Top of Switchboard (optional):
   1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
   2. Set back from front to clear circuit-breaker removal mechanism.
   3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
   4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
   5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

P. Buses and Connections: Three phase, four wire unless otherwise indicated.
   1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
   2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity.
   3. Copper feeder circuit-breaker line connections.
   4. Tin-plated aluminum feeder circuit-breaker line connections.
   5. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
   6. Ground Bus: Minimum-size required by UL 891, but not less than 1/4-by-2-inch- (6-by-50-mm-), hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.

7. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
8. Disconnect Links:
   a. Bond neutral bus to equipment-ground bus for switchboards utilized as separately derived systems.
9. Neutral Buses, 480Y/277 volt: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
10. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

Q. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.3 SURGE PROTECTION DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company.
3. Siemens Power Transmission & Distribution, Inc.
4. Square D; by Schneider Electric.

B. SPDs: Comply with UL 1449, Type 1.

C. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1.
1. SPDs with the following features and accessories:
   a. Integral disconnect switch.
   b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
   c. Indicator light display for protection status.
   d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
   e. Surge counter.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 250kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
1. Line to Neutral: 1200 V for 480Y/277 V / 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V / 1200 V for 208Y/120 V.
3. Line to Line: 2000 V for 480Y/277 V / 1000 V for 208Y/120 V.

F. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:
1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Line to Line: 1000 V.

G. SCCR: Equal or exceed 100 kA.

H. Nominal Rating: 20 kA.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current as calculated in the Short Circuit Study required by Specification Section 260572.
   1. Fixed circuit-breaker mounting.
   2. Two-step, stored-energy closing.
   3. Full-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:
      a. Instantaneous trip.
      b. Time adjustments for long- and short-time pickup.
      c. Ground-fault pickup level, time delay, and I^2t response.
   4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
   5. Remote trip indication and control.
   6. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.5 INSTRUMENTATION

A. Instrument Transformers: NEMA EI 21.1, and the following:
   1. Potential Transformers: NEMA EI 21.1; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
   2. Current Transformers: NEMA EI 21.1; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
   1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
      a. Phase Currents, Each Phase and Neutral: Plus or minus 0.5 percent.
      b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
      c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
      d. Megawatts: Plus or minus 1 percent.
      e. Megavars: Plus or minus 1 percent.
      f. Power Factor: Plus or minus 1 percent.
      g. Frequency: Plus or minus 0.1 percent.
      h. Phase-to-Neutral % Total Harmonic Distortion (THD)
      i. Phase Current % Total Harmonic Distortion (THD)
      j. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
      k. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
   2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

3. Communication Format: BACnet / IP Ethernet.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. IR Scanning Windows: Factory-installed IR Scanning windows to allow for infrared thermographic inspections without opening enclosure doors or removing covers.
   1. Environmental rating equal to or better than the switchboard enclosure rating
   2. Permanent labeling
   3. Placed to view:
      a. Main bus connections
      b. Feeder breaker line-side terminations
      c. Other critical terminations
   4. Quantity and locations shall be coordinated with switchboard manufacturer and shown on shop drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.
   1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
   2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
   3. Protect from moisture, dust, dirt, and debris during storage and installation.
   4. Install temporary heating during storage per manufacturer's instructions.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete" and Section 033053 "Miscellaneous Cast-in-Place Concrete."
   1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches (50-mm) above concrete base after switchboard is anchored in place.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
   3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to switchboards.
   6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in Section 260548 "Seismic Controls for Electrical Systems."

E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, surge protection devices, and instrumentation.
   1. Set field-adjustable switches and circuit-breaker trip ranges.

3.3 CONNECTIONS

A. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.

B. Support and secure conductors within the switchboard according to NFPA 70.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test ground-fault protection of equipment for service equipment per NFPA 70.
   2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   3. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   4. Perform the following infrared scan tests and inspections, and prepare reports:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
      b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
      c. Instruments and Equipment:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Switchboard will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. GFEP: Ground-fault equipment protection.

C. MCCB: Molded-case circuit breaker.

D. SPD: Surge protective device.

E. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.
   1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
   2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details.
   2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
   3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
   4. Detail bus configuration, current, and voltage ratings.
   5. Short-circuit current rating of panelboards and overcurrent protective devices.
   6. Include evidence of NRTL listing for SPD as installed in panelboard.

7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
   b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Owner no fewer than two weeks in advance of proposed interruption of electric service.
   2. Do not proceed with interruption of electric service without Owner's written permission.
   3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
   1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
   1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Seismic Controls for Electrical Systems."

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

F. Enclosures: Flush and Surface-mounted, dead-front cabinets as indicated on drawings.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor Locations including in water feature vaults: NEMA 250, Type 4X, stainless steel.
      c. Kitchen Areas: NEMA 1, stainless steel.
      d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4X.
   2. Height: 84 inches (2.13 m) maximum.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
4. Finishes:
   a. Panels and Trim: Steel and galvanized steel, unless stainless steel is specified elsewhere, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Galvanized steel.

G. Incoming Mains:
   1. Location: Convertible between top and bottom.

H. Phase, Neutral, and Ground Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity.
      a. Plating shall run entire length of bus.
      b. Bus shall be fully rated the entire length.
   2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
   3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
   4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box. Only required where indicated on drawings.
   5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

I. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Terminations shall allow use of 75 deg C rated conductors without derating.
   3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
   4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
   5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
   6. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

J. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

K. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices at all locations that are indicated in schedules as space or provision. Note that schedules may include provisions or spaces that are not shown on the one-line diagrams.

L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
   1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings not lower than the calculated symmetrical fault current magnitude as

calculated in the Short Circuit Study required by Specification Section 260572, but not less than 10,000 A rms symmetrical.

2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings not lower than the calculated symmetrical fault current magnitude as calculated in the Short Circuit Study required by Specification Section 260572, but not less than 14,000 A rms symmetrical.

M. SPD.
1. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
2. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
   a. Line to Neutral: 1200 V for 480Y/277 V / 700 V for 208Y/120 V.
   b. Line to Ground: 1200 V for 480Y/277 V / 700 V for 208Y/120 V.
   c. Neutral to Ground: 1200 V for 480Y/277 V /700 V for 208Y/120 V.
   d. Line to Line: 2000 V for 480Y/277 V /1200 V for 208Y/120 V.
3. SCCR: Equal to the SCCR of the panelboard in which installed or exceed 100 kA.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and will continue to function after the seismic event."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Mains: Circuit breaker or Lugs only as indicated on drawings.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.

2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only as indicated on drawings.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers:
   a. Inverse time-current element for low-level overloads.
   b. Instantaneous magnetic trip element for short circuits.
   c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:
   a. RMS sensing.
   b. Field-replaceable rating plug or electronic trip.
   c. Digital display of settings, trip targets, and indicated metering displays.
   d. Multi-button keypad to access programmable functions and monitored data.
   e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
   f. Integral test jack for connection to portable test set or laptop computer.
   g. Field-Adjustable Settings:
      1) Instantaneous trip.
      2) Long- and short-time pickup levels.
      3) Long and short time adjustments.
      4) Ground-fault pickup level, time delay, and I squared T response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. MCCB Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.

b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
i. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
j. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.6 INSTRUMENTATION

A. Instrument Transformers: NEMA EI 21.1, and the following:
1. Potential Transformers: NEMA EI 21.1; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: NEMA EI 21.1; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
a. Phase Currents, Each Phase and Neutral: Plus or minus 0.5 percent.
b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
d. Megawatts: Plus or minus 1 percent.
e. Megavars: Plus or minus 1 percent.
f. Power Factor: Plus or minus 1 percent.
g. Frequency: Plus or minus 0.1 percent.
h. Phase-to-Neutral % Total Harmonic Distortion (THD)
i. Phase Current % Total Harmonic Distortion (THD)
j. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
k. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door or remote mounted adjacent to panelboard. Where multiple panelboard meters are located within the same electrical room the meters may be mounted in a single enclosure with identification that clearly indicates the panelboard associated with the meter. Provide a separate meter for each panelboard that is indicated to have a meter installed.
3. Communication Format: BACnet / IP Ethernet.

2.7 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
   1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.8 ISOLATED POWER SYSTEM PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Square D; by Schneider Electric.
   2. Isotrol/Bender
   3. PG LifeLink

B. This section covers Isolated Power Panels Dual Systems that incorporate two (2) isolation transformers, two (2) primary circuit breaker, two (2) or more isolated ungrounded secondary circuits connected by conduit to remotely located receptacles, two (2) reference ground buses, and two (2) Line Isolation Monitors (LIM). There must be provisions for connection to remote indicators.

C. The equipment must be listed under UL1047 - Isolated Power Systems Equipment. The Components of these products covered under this standard are judged to include, but are not necessarily limited to the following:
   1. Article 517 of the National Electric Code, NFPA 70
   2. Standard for Health Care Facilities, NFPA 99
   3. Standard for Line Isolation Monitors, UL 1022
   4. Standard for Specialty Transformers, UL 506
   5. Standard for Cabinets and Boxes, UL 50

D. Product: this section imposes additional constraints on the product addressing such topics as construction details, size, operator interface, and component performance. This information is intended to supplement the requirements imposed by UL 1047 which is the guiding and governing document in all matters concerning this specification.

E. Enclosure for single phase isolated power panels dual systems up to 10kva:
   1. Backbox: flush mounted units shall be fabricated from 14GA galvanized sheet steel. There shall be a space for a backplate and a transformer shelf to mount an upright isolation transformer. The dimensions of the backbox shall be 71"H x 34"W x 8"D.
   2. Backplate: fabricated from 12GA galvanized sheet steel. The backplate shall provide a mounting surface for all isolated power panel components except for the isolation transformer. The backplate shall be mounted to the backbox by means of four (4) 1/4" - 20 studs.
   3. Heat Shield (Vertical & Horizontal): The vertical heat shield shall be .090" aluminum and the horizontal heat shield shall be 14GA galvanized sheet steel.

F. Front Trim: Shall be fabricated from 14GA Type 304 Stainless Steel, with #4 brushed finish and shall contain a flush door covering each circuit breaker section. Each door shall contain a flush, keylocking slam-latch capable of being latched whether the latchs are locked or not. A door stop shall shall be firmly attached to the interior of the front trim. All panels shall be keyed alike. Front trim shall contain one (1) cut out for each LIM, which shall remain visible at all times. The front trim for flush mounted units extends 1" on all sides of the backbox. The front trim shall be attached to the backbox by means of twenty (20) #10-32 x 1" Stainless Steel Oval Head Phillips machine screws and twenty (20) #10 Stainless Steel finishing washers.

G. Isolation Transformers:
1. Two (2) single phase, 50 or 60Hz with 480 volt, single phase, primary and 120 volt secondary.
2. Class H rated insulation.
3. Electrostatic shield between primary and secondary windings grounded to enclosure.
4. Electrostatic shield designed so that it will prevent direct shorting of primary winding to secondary winding, and will reduce the coupling of harmonic distortions between the primary and secondary circuits.
5. Core is of stacked design, securely clamped.
6. Core and coil vacuum impregnated with final wrap of insulating material.
7. Core and coils isolated from enclosure by means of a vibration dampening system.
8. Total leakage current to ground from transformer secondary winding in compliance withUL1047, Tables 30.1 and 30.2.
9. Maximum sound level of transformer: 35dB for 10 kVA units.
10. Temperature rise limited to 115 degree C above ambient under full load conditions.
11. Transformers UL listed or recognized as a component for the voltages, amperages, and kVA ratings required.

H. Line Isolation Monitors (LIM):
1. Solid state modular assembly of printed circuit boards utilizing SMD technology.
2. Continuous monitoring of the impedance of each phase to ground.
3. Must be capable of detecting all combinations of capacitive, resistive, balanced, unbalanced and hybrid faults.
4. Total Hazard Current (THC) set at the factory to either 2mA or 5mA and shall be field adjustable to either milliampere.
5. Combined analog and digital display of THC.
6. Audible alarm which sounds in the event of a hazardous condition.
7. Indicating LEDs to visually indicate the status of the system. Green to indicate “SAFE”, red to indicate“HAZARD” and amber to indicate that the audible alarm is in the “MUTE” mode. All LEDs and buttons shall be flush with the face of the LIM.
8. A “TEST” button on the LIM faces shall be activated to test all LIM functions. It shall not be possible to leave the button in the “TEST” position.
9. The LIMs shall perform an automatic self-calibration and self-check every twelve hours. An error code display shall alert the staff of an anomaly in the LIM / System operation.
10. Shall contain overload protection with an automatic reset feature.
11. It shall be possible to order the LIMs with an optional RS485 communication port and load monitoring.
12. Field terminals shall be available for wiring remote LIM indicators with or without a display of THC.
13. Shall be UL Recognized as a component.
14. Shall have an easy to clean rugged Lexon front foil.

I. Primary Circuit Breaker: Shall be one in each section, two-pole sized in accordance with NFPA 70 (N.E.C.) and UL 1047 Standard and selected based on the transformer 480 volt primary

voltage on the one-line diagrams. Full size, thermal magnetic type, with minimum 14,000 AIC rating. Primary breaker shall be from same manufacturer that is used for all other panelboards and switchboards.

J. Secondary Branch Circuit Breakers: Two-pole, bolt-on type, ampacities, and quantities based on the contract documents for each section. Sized in accordance with NFPA 70-2011 (N.E.C.) and UL 1047 Standard. Full size, thermal magnetic type with minimum 10,000 AIC. Secondary breakers shall be from same manufacturer that is used for all other panelboards and switchboards. Minimum 16 each for per isolation transformer.

K. Bus Bars: Copper.

L. Reference Ground Bus: Shall be copper and shall contain one (1) reference grounding buses for each section, each with a minimum of one (1) #4-2/0 main lugs and nineteen (19) #14-4 grounding lugs.

M. Remote Indicators for line isolation monitors: For each section of each Isolated Power Panel provide a single or multiple gang remote indicator which duplicates the audible and visual alarm indications of the LIM installed in the Isolated Power Panel Dual System. The remote indicator shall contain a green “SAFE” LED a red “HAZARD” LED and a “MUTE” button with integral amber LED. The remote indicator shall function as follows:
   1. The green LED stays illuminated when the leakage current is within predetermined limits.
   2. The green LED extinguishes and the red LED illuminates when the predetermined limit is exceeded; an audible alarm also sounds.
   3. When depressed, the “MUTE” button shall mute the audible alarm signal. Actuation of this button shall cause the integral amber LED to illuminate, indicating that the audible alarm has been silenced.
   4. When the leakage current has returned to the acceptable limit level, the alarm indicators shall automatically reset.
   5. Provide THC digital display.

2.9 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Equipment Mounting:
   1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete" or Section 033053 "Miscellaneous Cast-in-Place Concrete."
   2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
   3. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Comply with mounting and anchoring requirements specified in Section 260548 "Seismic Controls for Electrical Systems."

G. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

H. Mount panelboard cabinet plumb and rigid without distortion of box.

I. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

J. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

K. Mount surface-mounted panelboards to steel slotted supports 5/8 inch (16 mm) in depth. Orient steel slotted supports vertically.

L. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

M. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

N. Install filler plates in unused spaces.

O. For flush mounted panels only stub four 1-inch (27-EMT) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-EMT) empty conduits into raised floor space or below slab not on grade.

P. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

Q. Isolated Power System Installation:
1. Type XHHW wire with crosslinked polyethylene insulation and a dielectric constant of 3.5 or less shall be used for all branch circuit wiring.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Comply with commissioning requirements in specification section 019113 -General Commissioning Requirements, and specification section 260800 (BA2)

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

E. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test for low-voltage surge arrestors stated in NETA ATS, Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Do not perform optional tests. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Perform the following infrared scan tests and inspections and prepare reports:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
      b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
      c. Instruments and Equipment:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 TESTING AND CERTIFICATIONS FOR ISOLATED POWER SYSTEMS

A. An engineer or senior technician shall be provided by the manufacturer for final testing and acceptance of the Isolated Power System. The following tasks shall be performed:
   1. Simulate faults using the manufacturer’s test kit, or equivalent.
   2. Repeat this test at each receptacle to ascertain that the LIM and associated branch circuit are functioning properly.
   3. Check the calibration of the LIM meter using the manufacturer’s test kit, or equivalent, and record the readings. Record the date and data in a permanent log book.
   4. Certify that the system is properly installed and in correct working order.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. USB charger devices.
4. Isolated-ground receptacles.
5. Hospital-grade receptacles.
6. Tamper-resistant receptacles.
7. Weather-resistant receptacles.
8. Snap switches and wall-box dimmers.
9. Floor service outlets (floor boxes) and poke-through assemblies.
10. Pendant Cord Connector Devices (Drop Cords).
11. Cord Reels

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton (Arrow Hart).
2. Hubbell Incorporated; Wiring Device-Kellems.
3. Leviton Manufacturing Co., Inc.
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. All devices must be manufactured for use with modular plug-in connectors, shall comply with UL 2459 and shall be made with stranded building wire. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Hospital-Grade, Tamper Resistant, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Mechanical shutter system to help prevent insertion of foreign objects. Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from

mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
   1. Description: Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.4 GFCI RECEPTACLES

A. General Description:
   1. Straight blade, non-feed-through type.
   2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
   3. Include indicator light that illuminates only when the GFCI has malfunctioned or tripped and no longer provides proper GFCI protection.

B. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

C. Hospital-Grade, Tamper Resistant, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

2.5 TWIST-LOCKING RECEPTACLES

A. Provide NEMA configurations as indicated on drawings.

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description:
   1. Matching, locking-type plug and receptacle body connector.
   2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
   3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
   4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 CORD REELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Kitchen Leash by APC Group

B. Description:
   1. Molded Polypropylene Housing.
   2. Retracting cord with adjustable stop.
   3. SJOW Power cord, 10 foot; rated 200 degrees.

4. Receptacles Dual Duplex NEMA 5-20R unless noted otherwise.
5. Impact: UL746C
6. Hose Down: CSA 6.8.2
7. Strain Relief: CSA 6.4
8. Flame Retardant: UL 94-94V-2
9. Mounting Bracket for ceiling mount.

2.8 CORD AND PLUG SETS

A. Description:
1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:
1. Single Pole and Three Way:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Eaton (Arrow Hart).
2) Hubbell Incorporated; Wiring Device-Kellems.
3) Leviton Manufacturing Co., Inc.
4) Pass & Seymour/Legrand (Pass & Seymour).

C. Key-Operated Switches, 120/277 V, 20 A:
1. Description: Single pole, with factory-supplied key in lieu of switch handle.
a. Public Restrooms and Other Spaces: Keyed switch, heavy duty specification grade (Pass & Seymour PS20AC1-WL or equivalent).
b. Behavioral Health Patient Accessible Spaces: Keyed locking switch, extra heavy duty specification grade security switch (Pass & Seymour PS20AC1-KL or equivalent). Coordinate common or differentiated keying of multiple switches with owner.

D. Momentary Contact Switches: 2-Button, Single Pole, Low-voltage switch, mounts in standard single gang ring.

E. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

F. Decora style rocker switches are not permitted.

2.10 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable full width slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module for off.
   1. These shall be used to control power modules driving large quantity of LED drivers using 0-10VDC control signals. This interface shall operate either 120 or 277 volt circuits, 200 ma rating.

D. Decora style rocker switches are not permitted.

E. LED and Low Voltage Dimmer Switches:
   1. Modular; compatible with LED drivers; trim potentiometer to adjust low-end dimming used where “LR” is shown, otherwise full range of 1% to 100% of lumen output or as noted.
   2. Maximum of four (4) buttons per gang.
   3. Dimmer shall operate either 120 or 277 volt circuits, 28 ma minimum rating.
   4. Touch dimming switches shall cover the full range of dimming with a single press-and-hold function in not more than three (3) seconds.
   5. Switches, with LED indicators to indicate both ON and OFF status, shall be available with 2 or 4 single button switches per gang. Switch to fit standard Decora opening.
   6. Switches and switch hardware shall mount to standard wall boxes.
   7. Each switch shall provide a location for a label to identify function. The label shall be under a clear plastic cover and shall be field replaceable should the operation of the switch change. Permanently etched switches are not acceptable unless specifically noted otherwise.

F. Slide Dimmer Locations:
   1. Exam Rooms, Imaging Rooms, Operating Rooms, Procedure Rooms, Recovery Bays, and Imaging Control Rooms: Provide slide dimmer switches; do not provide touch dimming switches in these spaces except when an integrated component of an antimicrobial or integrated operating room ceiling system.

2.11 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
   1. Plate-Securing Screws (behavioral health spaces): Metal tamper resistant TORX screws with head color to match plate finish.
   2. Plate-Securing Screws (other than behavioral health spaces): Metal with head color to match plate finish.
   3. Material for Finished Spaces, except Operating Rooms, Food Service Kitchens, and Behavioral Health Spaces: Smooth, high-impact thermoplastic.
   4. Material for Operating Rooms and Food Service Kitchen: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.
   5. Material for Behavioral Health Spaces: Smooth, nylon, unbreakable, with a minimum of two (2) screws per gang; provide Torx head tamper resistant screws.
   6. Material for Unfinished Spaces: Galvanized steel.

7. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable, weatherproof-in-use cover.

2.12 FLOOR SERVICE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Wiremold / Legrand.

B. Type: Modular, flush-type, dual- or multi- service units suitable for wiring method used.

C. Compartments: Barrier separates power from voice and data communication cabling.

D. Service Plate: Round, die-cast aluminum with satin finish.

E. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

F. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in owner's Section 270000 requirements.

G. Description by Device Type:

FB1	Flush, Dual Service, Furniture Feed. One .75" conduit for power and One 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFBFF Hubbell CFB2G30/2GCFFCVR
FB4	Flush, Dual Service, one piece finish flange. Four gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFG45S Hubbell CFB2G30/24GCCVR
FB6	Flush, Dual Service, one piece finish flange. Six gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB6S Evolution Hubbell CFB6G30/610GCCVR
FB8	Flush, Dual Service, one piece finish flange. Eight gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB8S Evolution
FB10	Flush, Dual Service, one piece finish flange. Ten gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB10S Evolution Hubbell CFB10G30/610GCCVR
FB11	Flush single service floor box suitable for the wiring method used. NEMA 5-20R duplex receptacle with brushed aluminum flange and cover plate. Hinged	Legrand 880MS(CS)/817/828 Hubbell B2431/S3825

	receptacle covers. Housing material shall be stamped steel above grade and cast iron at grade. Provide appropriate carpet and tile flanges.	

2.13 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Wiremold / Legrand.

B. Description:
   1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
   2. Comply with UL 514 scrub water exclusion requirements.
   3. Size: Selected to fit cored holes in floor and matched to floor thickness.
   4. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
   5. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.

C. Description by Device Type:

PT1	Flush, Dual Service, 4” Diameter Furniture Feed Poke-Thru. One piece finish flange. One .75” conduit for power, One 1.5” conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand 4FFATC Hubbell PT73FFS/FRF3
PT2	Flush, Dual Service Capable, 4”Diameter Poke-Thru. One .75” conduit for power, one 1.5” conduit for data cabling. Two Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 4AT Evolution Hubbell S1R4PT
PT3	Flush, Dual Service Capable, 6”Diameter Poke-Thru. One .75” conduit for power, one 1.5” conduit for data cabling. Three Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 6AT Evolution Hubbell S1R6PT
PT8	Flush, Dual Service Capable, 8”Diameter Poke-Thru. One .75” conduit for power, one 2” conduit for data cabling. Five Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 8AT Evolution Hubbell S1R8PT
PT10	Flush, Dual Service Capable, 10”Diameter Poke-Thru. One .75” conduit for power, one 2” conduit for data cabling. Eight Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 10AT Evolution Hubbell S1R10PT

PT1 1	Flush single service floor box suitable for the wiring method used. NEMA 5-20R duplex receptacle with brushed aluminum flange and cover plate. Hinged receptacle covers.	Legrand RC7CTC Hubbell PT7FS/FRF

2.14 FINISHES

A. Device Color:
1. Wiring Devices Connected to Normal Power System: Gray in Food Service Kitchen. As selected by Architect in other finished spaces unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Essential Power System: Red.
3. Isolated-Ground Receptacles: Orange.
4. UPS receptacles: Grey

B. Wall Plate Color:
1. Plastic covers: Match device color.
2. Cover plates for receptacles mounted above data racks in TEC and TDR rooms: Provide blue cover plates for receptacles served by UPS-A and red cover plates for receptacles served by UPS-B.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
3. Install 0-10VDC control wiring in conduit with power wiring. Use conductors with insulation equivalent to insulation of power wiring.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor boxes and pokethroughs to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
   2. Test Instruments: Use instruments that comply with UL 1436.
   3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight-blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g). Submit test report indicting each receptacle and test result.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Cartridge fuses rated 600-V ac and less for use in enclosed switches, panelboards and enclosed controllers.,
2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
   a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Ambient temperature adjustment information.
2. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.7 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.4 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

2.5 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:
   1. Feeders: Class J, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).

4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Manufacturer's field service report.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
   2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
   2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Owner no fewer than 2 weeks days in advance of proposed interruption of electric service.
   2. Indicate method of providing temporary electric service.
   3. Do not proceed with interruption of electric service without Owner's written permission.
   4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Eaton.
   2. General Electric Company.
   3. Siemens Industry, Inc.
   4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses,

lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.
7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D; by Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Instantaneous trip.
   2. Long- and short-time pickup levels.
   3. Long- and short-time time adjustments.
   4. Ground-fault pickup level, time delay, and I^2t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
   4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
   5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R.
   3. Kitchen Locations (other than Wash Down Areas): NEMA 250, Type 4X, stainless steel.
   4. Kitchen Wash Down Areas: NEMA 250, Type 4X, stainless steel.
   5. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
   6. Imaging Rooms: Flush Mount.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION

SECTION 26 29 13
ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:
   1. Full-voltage magnetic.

B. Related Section:
   1. Section 262923 "Variable-Frequency Motor Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on variable torque loads in ranges up to 200 hp.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
   1. Show tabulations of the following:
      a. Each installed unit's type and details.
      b. Factory-installed devices.
      c. Nameplate legends.
      d. Short-circuit current rating of integrated unit.
      e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
      f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
   2. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

D. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

E. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Routine maintenance requirements for enclosed controllers and installed components.
   2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
   3. Manufacturer's written instructions for setting field-adjustable overload relays.
   4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

1.8 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
   2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
   3. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
   4. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
   2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
   1. Notify Owner no fewer than two weeks in advance of proposed interruption of electrical systems.
   2. Indicate method of providing temporary utilities.
   3. Do not proceed with interruption of electrical systems without Owner's written permission.
   4. Comply with NFPA 70E.

1.12 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Magnetic Controllers: Full voltage, across the line, electrically held.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eaton.
   b. General Electric Company.
   c. Siemens Industry, Inc.
   d. Square D; by Schneider Electric.
2. Configuration: Nonreversing.
3. Contactor Coils: Pressure-encapsulated type.
   a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 120 -V ac; obtained from integral CPT, with primary and secondary fuses, with CPT control power source of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
   a. CPT Spare Capacity: 50 VA.
6. Solid-State Overload Relay:
   a. Switch or dial selectable for motor running overload protection.
   b. Sensors in each phase.
   c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
7. External overload reset push button.

2.2 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
1. Selector Switches: Heavy-duty, oiltight type.
   a. Pilot Lights: LED types; colors as indicated.
   b. Selector Switches: Rotary type.

B. Reversible N.C./N.O. auxiliary contact(s).

C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Install fuses in each fusible-switch enclosed controller.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved nameplate.
   3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices and facility's central control system.

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.
   1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.

2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

D. Tests and Inspections:
   1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
   2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
   3. Test continuity of each circuit.
   4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
   5. Test each motor for proper phase rotation.
   6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
      b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multi-pole enclosed controller 11 months after date of Substantial Completion.
      c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Enclosed controllers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.

D. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION

SECTION 26 29 23
VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

1.3 DEFINITIONS

A. CE: Conformite Europeene (European Compliance).

B. CPT: Control power transformer.

C. DDC: Direct digital control.

D. EMI: Electromagnetic interference.

E. LED: Light-emitting diode.

F. NC: Normally closed.

G. NO: Normally open.

H. OCPD: Overcurrent protective device.

I. PID: Control action, proportional plus integral plus derivative.

J. RFI: Radio-frequency interference.

K. VFC: Variable-frequency motor controller.

L. VFD: Variable-frequency motor controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated.

1. Include dimensions and finishes for VFCs.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each VFC indicated.

1. Include mounting and attachment details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Required working clearances and required area above and around VFCs.

2. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements.

3. Show support locations, type of support, and weight on each support.

4. Indicate field measurements.

B. Qualification Data: For testing agency.

C. Seismic Qualification Certificates: For each VFC, accessories, and components, from manufacturer.

1. Certificate of compliance.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based, and their installation requirements.

D. Product Certificates: For each VFC from manufacturer.

E. Harmonic Analysis Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   a. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.
   b. Manufacturer's written instructions for setting field-adjustable overload relays.
   c. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
   d. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
   e. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.
   f. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than five of each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB.

2. DanFoss.

3. Eaton.

4. Yaskawa Electric America, Inc.

2.2 SYSTEM DESCRIPTION

A. General Requirements for VFCs:

1. VFCs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.

B. Application: variable torque.

C. VFC Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors, as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both" and operation of inverter-duty motors as defined by NEMA MG 1, Section IV, part 31, "Definite Purpose Inverter-Fed Polyphase Motors."

2. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

E. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

F. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 15 percent of VFC input voltage rating.

2. Input AC Voltage Unbalance: Not exceeding 5 percent.

3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.

4. Minimum Efficiency: 98% percent at 60 Hz, full load.

5. Minimum Displacement Primary-Side Power Factor: 98 percent under any load or speed condition.

6. Minimum Short-Circuit Current (Withstand) Rating: Not less than the rating of the switchboard or panelboard that supplies the controller.

7. Ambient Temperature Rating: Not less than 32 deg F (0 deg C) and not exceeding 104 deg F (40 deg C).

8. Humidity Rating: Less than 95 percent (noncondensing).

9. Altitude Rating: Not exceeding 3300 feet (1000 m).

10. Vibration Withstand: Comply with NEMA ICS 61800-2.

11. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.

12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.

13. Speed Regulation: Plus or minus 5 percent.

14. Output Carrier Frequency: Selectable; 1 to 12.5 kHz.

15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

G. Inverter Logic: Microprocessor based, 32 bit, isolated from all power circuits.

H. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Optical.

I. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.

2. Maximum Speed: 80 to 100 percent of maximum rpm.

3. Acceleration: 0.1 to 999.9 seconds.

4. Deceleration: 0.1 to 999.9 seconds.

5. Current Limit: 30 to minimum of 150 percent of maximum rating.

J. Self-Protection and Reliability Features:

1. Surge Suppression: Factory installed as an integral part of the VFC, complying with UL 1449 SPD, Type 1 or Type 2.

2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.

3. Under- and overvoltage trips.

4. Inverter overcurrent trips.

5. VFC and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor-overload alarm and trip; settings selectable via the keypad.

6. Critical frequency rejection, with three selectable, adjustable deadbands.

7. Instantaneous line-to-line and line-to-ground overcurrent trips.

8. Loss-of-phase protection.

9. Reverse-phase protection.

10. Short-circuit protection.

11. Motor-overtemperature fault.

K. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

L. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

M. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

N. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

O. Integral Input Disconnecting Means and OCPD: Any of the following are acceptable. Selection should be based upon requirements for Short-Circuit Current (Withstand) Rating. UL 489, instantaneous-trip circuit breaker, UL 489, molded-case switch, with power fuse block and current-limiting fuses, UL 489, thermal-magnetic circuit breaker, NEMA KS 1, nonfusible switch, with power fuse block and current-limiting fuses, NEMA KS 1, fusible switch with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: Not less than 115 percent of VFC input current rating.

2. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.

3. Auxiliary Contacts: NO or NC, arranged to activate before switch blades open.

4. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.

5. NO alarm contact that operates only when circuit breaker has tripped.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. The designated VFCs shall be tested and certified by an NRTL as meeting the ICC-ES AC 156 test procedure requirements.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.4 CONTROLS AND INDICATION

A. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.

2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
   a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

3. Indicating Devices: Digital display integral to the Operator Station to display VFC parameters including, but not limited to:
   a. Output frequency (Hz).
   b. Motor speed (rpm).
   c. Motor status (running, stop, fault).
   d. Motor current (amperes).
   e. Motor torque (percent).
   f. Fault or alarming status (code).
   g. PID feedback signal (percent).
   h. DC-link voltage (V dc).
   i. Set point frequency (Hz).
   j. Motor output voltage (V ac).

B. Historical Logging Information and Displays: Available through the Operator Station.

C. Control Signal Interfaces:

1. Electric Input Signal Interface:
   a. A minimum of two programmable analog inputs: 0- to 10-V dc and 4- to 20-mA dc.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC system for HVAC or other control systems:
   a. 0- to 10-V dc.
   b. 4- to 20-mA dc.
   c. Potentiometer using up/down digital inputs.
   d. Fixed frequencies using digital inputs.

3. Output Signal Interface: A minimum of two programmable analog output signal(s) 0- to 10-V dc and 4- to 20-mA dc), which can be configured for any of the following:
   a. Output frequency (Hz).
   b. Output current (load).
   c. DC-link voltage (V dc).
   d. Motor torque (percent).
   e. Motor speed (rpm).
   f. Set point frequency (Hz).

D. Interface with DDC System for HVAC: Factory-installed hardware and software shall interface with DDC system for HVAC to monitor, control, display, and record data for use in processing reports. VFC settings shall be retained within VFC's nonvolatile memory.

1. Communication Interface: Comply with ASHRAE 135. Communication shall interface with DDC system for HVAC to remotely control and monitor lighting from a DDC system for HVAC operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the DDC system for HVAC.

2.5 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: Based on the manufacturer's harmonic analysis study and report, provide input filtering, as required, to limit total demand (harmonic current) distortion and total harmonic voltage demand at the defined point of common coupling to meet IEEE 519 recommendations.

B. EMI/RFI Filtering: Certify compliance with IEC 61800-3 for Category C2.

2.6 OPTIONAL FEATURES

A. Multiple-Motor Capability: VFC suitable for variable-speed service to multiple motors. Overload protection shuts down VFC and motors served by it, and generates fault indications when overload protection activates.

1. Configure to allow two or more motors to operate simultaneously at the same speed; separate overload relay for each controlled motor.

B. Damper control circuit with end-of-travel feedback capability.

C. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.

D. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.

E. Firefighter's Override (Smoke Purge) Input: On a remote contact closure from the firefighter's control station, this password-protected input:

1. Overrides all other local and external inputs (analog/digital, serial communication, and all keypad commands).

2. Forces VFC to operate motor, without any other run or speed command, at a field-adjustable, preset speed.

3. Forces VFC to transfer to bypass mode and operate motor at full speed.

4. Causes display of override mode on the VFC display.

5. Reset VFC to normal operation on removal of override signal automatically.

F. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

G. Remote digital operator kit.

H. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

2.7 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.

B. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFC as "Plenum Rated."

2.8 ACCESSORIES

A. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

B. Cooling Fan and Exhaust System: For NEMA 250, Type 1; UL 508 component recognized: Supply fan, with composite intake and exhaust grills and filters; 120-V ac; obtained from integral CPT.

2.9 SOURCE QUALITY CONTROL

A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.

1. Test each VFC while connected to a motor that is comparable to that for which the VFC is rated.

2. Verification of Performance: Rate VFCs according to operation of functions and features specified.

B. VFCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Floor-Mounting Controllers: Install VFCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete" or Section 033053 "Miscellaneous Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Roof-Mounting Controllers: Install VFC on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.

1. Curbs and roof penetrations are specified in Section 077200 "Roof Accessories."

2. Structural-steel channels are specified in Section 260529 "Hangers and Supports for Electrical Systems."

D. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

F. Install fuses in each fusible-switch VFC.

G. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

H. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.

I. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

J. Comply with NECA 1.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.

2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.4 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each VFC with engraved nameplate.

3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.5 FIELD QUALITY CONTROL

A. Comply with commissioning requirements in specification section 019113 -General Commissioning Requirements, and specification section 260800 (BA2)

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.

2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.

3. Test continuity of each circuit.

4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).

5. Test each motor for proper phase rotation.

6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Perform the following infrared (thermographic) scan tests and inspections, and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFC. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFC 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. VFCs will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

F. Set field-adjustable pressure switches.

3.8 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION

SECTION 26 32 13
ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes packaged engine-generator sets for emergency standby power supply with the following features:

1. Diesel engine.
2. Unit-mounted cooling system.
3. Unit-mounted and remote-mounted control and monitoring.
4. Performance requirements for sensitive loads.
5. Fuel system.
6. Parallel generator sets.
7. Load banks.

B. Related Requirements:

1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.
2. Section 262313 "Paralleling Low-Voltage Switchgear" for controls and paralleling equipment for large or multiple parallel engine generators.
3. Section 260800 “Electrical Commissioning” for commissioning requirements.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

B. EPS: Emergency power supply.

C. EPSS: Emergency power supply system.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor, with air supply temperature of 95, 80, 70, and 50 deg F. Provide drawings showing requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to kw rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine-generator set and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For engine-generator set, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails identify center of gravity and total weight, external silencer, subbase-mounted fuel tank, and each piece of equipment not integral to the engine-generator set, and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control reports, including, but not limited to the following:

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.

4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

C. Field quality-control reports.

D. Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   a. Operating instructions laminated and mounted adjacent to generator location.
   b. Training plan.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Tools: Each tool listed by part number in operations and maintenance manual.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion or 1,500 hours (Include parts, labor and travel).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Caterpillar; Engine Div.
2. Onan/Cummins Power Generation; Industrial Business Group.

B. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Engine-generator set housing, day tank, engine-generator set, batteries, battery racks, silencers, and sound attenuating equipment, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Shake-table testing shall comply with ICC-ES AC156. Testing shall be performed with all fluids at worst case normal levels.
3. Component Importance Factor: 1.5.

B. ASME Compliance: Comply with ASME B15.1.

C. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

D. UL Compliance: Comply with UL 2200.

E. Engine Exhaust Emissions: Comply with EPA Tier 2 requirements and applicable state and local government requirements.

F. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 4,800 ft.

G. Commissioning of the equipment’s required for the contractor and vender per specification 019113

2.3 ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. EPSS Class: Engine-generator set shall be classified as a Class 2 in accordance with NFPA 110.

D. Induction Method: Turbo Charged-After Cooled

E. Governor: Adjustable isochronous, with speed sensing.

F. Emissions: Comply with EPA Tier 2 requirements.

G. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

H. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

I. Generator-Set Performance for Sensitive Loads:

1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.

   a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.

2. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
3. Transient Voltage Performance: Not more than 13 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.
4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
6. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
8. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
9. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.

a. Provide permanent magnet excitation for power source to voltage regulator.

10. Start Time: Comply with NFPA 110, Type 10, system requirements.

J. Parallel Engine Generators:

1. Automatic reactive output power control and load sharing between generator sets operated in parallel.
2. Automatic regulation, automatic connection to a common bus, and automatic synchronization, with manual controls and instruments to monitor and control paralleling functions.
3. Protective relays required for equipment and personnel safety.
4. Paralleling suppressors to protect excitation systems.
5. Reverse power protection.
6. Loss of field protection.

2.4 ENGINE

A. Fuel: Fuel oil, Grade DF-2.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

G. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be 75 dBA or less.

H. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

I. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Lead acid, maintenance free, AGM type, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 A minimum continuous rating.
9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F (minus 40 deg C) to 140 deg F (plus 60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.
c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.

e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 DIESEL FUEL-OIL SYSTEM

A. Comply with NFPA 30.

B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in Section 231113 "Facility Fuel-Oil Piping." Cast iron, aluminum, copper, and galvanizing shall not be used in the fuel-oil system.

C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

D. Fuel Filtering: Remove water and contaminants larger than 1 micron.

E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Day Tank: Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank with integral, float-controlled transfer pump and the following features:

1. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.

   a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.

2. Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of 4 hours' operation at 100 percent of rated power output of engine-generator system without being refilled.
3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.
4. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
5. High-Level Alarm Sensor: Liquid-level device operates alarm and redundant fuel shutoff contacts at midpoint between overflow level and 100 percent of normal fuel level.
6. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve.
7. Redundant High-Level Fuel Shutoff: Actuated by high-level alarm sensor in day tank to operate a separate motor control device that disconnects day-tank pump motor. Sensor shall signal solenoid valve, located in fuel suction line between fuel storage tank and day tank, to close. Both actions shall remain in shutoff state until manually reset. Shutoff action shall initiate an alarm signal to control panel but shall not shut down engine-generator set.

G. Provide controls and fuel pumps to transport fuel to/from main fuel tank. Provide return pump with floats and controls. Comply with requirements in Section 231213 "Facility Fuel-Oil Pumps."

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

C. Provide minimum run time control set for 30 minutes with override only by operation of a remote emergency-stop switch.

D. Comply with UL 508A.

E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine-generator set battery.

F. Protective Devices and Controls in Local Control Panel: Shutdown devices and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:

1. Start-stop switch.
2. Overcrank shutdown device.
3. Overspeed shutdown device.
4. Coolant high-temperature shutdown device.
5. Coolant low-level shutdown device.
6. Low lube oil pressure shutdown device.
7. Overcrank alarm.
8. Overspeed alarm.
9. Coolant high-temperature alarm.
10. Coolant low-temperature alarm.
11. Coolant low-level alarm.
12. Low lube oil pressure alarm.
13. Lamp test.
14. Contacts for local and remote common alarm.
15. Coolant high-temperature prealarm.
16. Generator-voltage adjusting rheostat.
17. Main fuel tank low-level alarm.

    a. Low fuel level alarm shall be initiated when the level falls below that required for operation for the duration required in "Fuel Tank Capacity" Paragraph in "Diesel Fuel-Oil System" Article.

18. Run-Off-Auto switch.
19. Control switch not in automatic position alarm.
20. Low cranking voltage alarm.
21. Battery-charger malfunction alarm.

22. Battery low-voltage alarm.
23. Battery high-voltage alarm.
24. Generator overcurrent protective device not closed alarm.

G. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

H. Connection to Datalink: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication. Provide connections for datalink transmission of indications to remote data terminals via BacNet MSTP protocol. ~~Data system connections to terminals are covered in Section 260913 "Electrical Power Monitoring and Control."~~

I. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.
2. Coolant low-temperature alarm.
3. High engine temperature prealarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low fuel main tank alarm.
8. Low coolant level alarm.
9. Low cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Run-Off-Auto switch.
13. Control switch not in automatic position alarm.
14. Fuel tank low alarm.
15. Fuel tank high-level shutdown of fuel supply alarm.
16. Lamp test.
17. Low cranking voltage alarm.
18. Generator overcurrent protective device not closed.

J. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

K. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation. Mount on exterior of generator enclosure unless otherwise noted in plans.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.

1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

D. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.

1. Indicate ground fault with other generator-set alarm indications.
2. Trip generator protective device on ground fault.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide 12 lead alternator.

E. Range: Provide broad range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.
   1. Maintain voltage within 20 percent on one step, full load.
   2. Provide anti-hunt provision to stabilize voltage.
   3. Maintain frequency within 10 percent and stabilize at rated frequency within 5 seconds.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 16 percent, maximum.

2.9 VIBRATION ISOLATION DEVICES

A. As recommend by manufacturer to maintain seismic certification

B. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.10 ENCLOSURE LIGHTING

A. Exterior Enclosures: Provide service lighting with integral battery backup within generator enclosure where packaged generator set is located outdoors.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.12 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

   1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

   1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
   2. Test generator, exciter, and voltage regulator as a unit.
   3. Full load run.
   4. Maximum power.
   5. Voltage regulation.

6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdown.
9. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
10. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
3. Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators. These items are specified in Section 077200 "Roof Accessories."

C. Install packaged engine-generator to provide access, without removing connections or accessories, for periodic maintenance.

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine-generator to allow service and maintenance.

C. Connect engine exhaust pipe to engine with flexible connector.

D. Connect fuel piping from adjacent day tank (BA2) to engines with a gate valve and union and flexible connector. Day tank provided by division 231113 (BA2)

1. Diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems are specified in Section 231113 "Facility Fuel-Oil Piping."

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90 degree bend in flexible conduit routed to the generator set from a stationary element.

3.4 IDENTIFICATION

A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.5 FIELD QUALITY CONTROL

A. Comply with commissioning requirements in specification section 019113 -General Commissioning Requirements, and specification section 260800 (BA2)

B. 260800 Electrical Commissioning (BA2)

C. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

E. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections.

F. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs as specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.

a. Visual and Mechanical Inspection

1) Compare equipment nameplate data with drawings and specifications.
2) Inspect physical and mechanical condition.
3) Inspect anchorage, alignment, and grounding.
4) Verify the unit is clean.

b. Electrical and Mechanical Tests

1) Perform insulation-resistance tests in accordance with IEEE 43.

a) Machines larger than 200 horsepower (150 kilowatts). Test duration shall be 10 minutes. Calculate polarization index.

2) Test protective relay devices.
3) Verify phase rotation, phasing, and synchronized operation as required by the application.
4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
5) Conduct performance test in accordance with NFPA 110.
6) Verify correct functioning of the governor and regulator.
7) *Provide the engineer and commissioning agent with a start up report and completed warranty documents with in one week of start-up.*

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
c. Verify acceptance of charge for each element of the battery after discharge.
d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
8. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
9. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations 25 feet (7.6 m) from edge of the generator enclosure, and compare measured levels with required values.

G. Coordinate tests with tests for transfer switches and run them concurrently.

H. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

I. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

J. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

K. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

L. Remove and replace malfunctioning units and reinspect as specified above.

M. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

N. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213

SECTION 263600
TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. 019113 – GENERAL COMMISIONING REQUIREMENTS

C. 260800 – COMMISIONING ELECTRICAL SYSTEMS

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:
   1. Automatic Bypass/isolation switches.
   2. Critical Power Management System (CPMS)
   3. Remote Critical Power Management Terminals
   4. Remote Connectivity.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
   1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
      b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Features and operating sequences, both automatic and manual.
   2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

B. Provide Engineer and Commissioning Agent with a start-up report and completed warranty documents within one week of start-up.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain automatic transfer switches and remote annunciator and control panels through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with commissioning requirements in specification section 019113 -General Commissioning Requirements, and specification section 260800 (BA2)

F. Comply with NEMA ICS 1.

G. Comply with NFPA 70.

H. Comply with NFPA 99.

I. Comply with NFPA 110.

J. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
   1. Notify Construction Manager no fewer than 7 days in advance of proposed interruption of electrical service.
   2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by ASCO.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
   1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
   1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
   2. Switch Action: Double throw; mechanically held in both directions.
   3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles with overlapping neutral contacts.

H. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."
   1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
   2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
   3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

J. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

K. The transfer switch shall have a load shedding circuit for initiated by closing of customer supplied contact. Relay de-energization opens emergency contactor (CE) disconnecting the load from the emergency source. If normal source is acceptable the normal source contactor (CN) is closed to connect the load to the normal source. When load is reconnected to normal, the control panel is reset in readiness for the next normal source failure. A manual 2 position load shed override toggle switch shall be provided.

L. Transfer Switches which are rated for 1200A or less will not require rear nor side access. Pull boxes are to be included as necessary, per the project drawings.

2.3 CLOSED TRANSITION BYPASS / ISOLATION AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
   1. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
   2. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations.
   3. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
   4. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.
   5. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.
   6. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.
   7. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.

C. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

D. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

E. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

F. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

G. Automatic Closed-Transition Transfer Switches: Connect both sources to load momentarily. Transition is controlled by programming in the automatic transfer-switch controller.

   1. Fully automatic make-before-break operation when transferring between two available power sources.
   2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.

3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
   a. Automatic transfer-switch controller takes active control of generator to match frequency, phase angle, and voltage.
   b. Controls ensure that closed-transition load transfer closure occurs only when the two sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.

4. Failure of power source serving load initiates automatic break-before-make transfer.

2.4 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
   1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
   2. Switch position.
   3. Switch in test mode.
   4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
   1. Indicating Lights: Grouped for each transfer switch monitored.
   2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
   3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
   4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.5 REMOTE ANNUNCIATOR AND CONTROL SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
   1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
   2. Switch position.
   3. Switch in test mode.
   4. Failure of communication link.

2.6 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Floor-Mounting Switch: Anchor to floor by bolting.
   1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct

concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."

C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

D. Identify components according to Section 260553 "Identification for Electrical Systems."

E. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
   a. Check for electrical continuity of circuits and for short circuits.
   b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   c. Verify that manual transfer warnings are properly placed.
   d. Perform manual transfer operation.
5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
   a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
   b. Verify time-delay settings.
   c. Verify pickup and dropout voltages by data readout or inspection of control settings.
   d. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
   e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
   f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

C. Testing Agency's Tests and Inspections:
1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
   a. Check for electrical continuity of circuits and for short circuits.
   b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   c. Verify that manual transfer warnings are properly placed.
   d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
   a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
   b. Simulate loss of phase-to-ground voltage for each phase of normal source.
   c. Verify time-delay settings.
   d. Verify pickup and dropout voltages by data readout or inspection of control settings.
   e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
   f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
   g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
   a. Verify grounding connections and locations and ratings of sensors.

D. Coordinate tests with tests of generator and run them concurrently.

E. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

F. Remove and replace malfunctioning units and retest as specified above.

G. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training.

B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 26 41 13
LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes lightning protection system for ordinary structures.

B. Section includes lightning protection system for the following:
   1. Ordinary structures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
   2. Include raceway locations needed for the installation of conductors.
   3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
   4. Include roof attachment details, coordinated with roof installation.
   5. Calculations required by NFPA 780 for bonding of metal bodies.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Lightning protection cabling attachments to roofing systems and accessories.
   2. Lightning protection strike termination device attachment to roofing systems, coordinated with the roofing system manufacturer.
   3. Lightning protection system components penetrating roofing and moisture protection systems and system components, coordinated with the roofing system manufacturer.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For lightning protection system to include in maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
a. Dimensioned site plan showing dimensioned route of the ground loop conductor and the ground rod locations. Comply with requirements of Section 017839 "Project Record Documents."
b. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.

B. Completion Certificate:
1. LPI Master Certificate.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: LPI Master Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ERICO International Corporation.
2. Harger Lightning & Grounding.
3. Heary Bros. Lightning Protection Co. Inc.
4. Thompson Lightning Protection, Inc.
5. VFC Lightning Protection, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements for Class II buildings.

B. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.

2.3 MATERIALS

A. Air Terminals:
1. Aluminum unless otherwise indicated.
2. 5/8-inch (16-mm) diameter by 12 inches (305 mm) long.

3. Rounded tip.
4. Threaded base support.

B. Class II Main Conductors:
1. Aluminum: 192,000 circular mils in diameter.

C. Secondary Conductors:
1. Aluminum: 41,400 circular mils in diameter.

D. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches (203 mm) in radius and narrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 200 feet (60 m) of building. Comply with requirements for concealed systems in NFPA 780.
1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
2. Install conduit where necessary to comply with conductor concealment requirements.
3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

3.2 CONNECTIONS

A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.

B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: high compression.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
   1.
   2. Perform inspections to obtain an LPI certification.

B. Prepare test and inspection reports and certificates.

END OF SECTION

SECTION 26 51 19
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.
3. Standby Emergency Power supplies for individual luminaires

B. Related Requirements:
1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 260936 "Standalone Multipreset Modular Dimming Controls" for architectural dimming systems and for fluorescent dimming controls with dimming ballasts specified in interior lighting Sections.
3. Section 260943 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project. Report data compliant with IES LM-79 and IES LM-80. Only Absolute Photometry is acceptable.
   a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products (NVLAP).

B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

C. LEED Submittals:
   1. Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
   2. Laboratory Test Reports for Credit IEQ 4.2: For paints and coatings, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Samples: For each luminaire and for each color and texture with standard factory-applied finish.

E. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
   1. Include Samples of luminaires and accessories involving color and finish selection.

F. Samples for Verification: For each type of luminaire.
   1. Include Samples of luminaires and accessories to verify finish selection.

G. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Lighting luminaires.
   2. Suspended ceiling components.
   3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
   4. Structural members to which equipment and or luminaires will be attached.
   5. Initial access modules for acoustical tile, including size and locations.
   6. Items penetrating finished ceiling, including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Ceiling-mounted projectors.
g.

7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of luminaire.

F. Product Test Reports: For each luminaire, for tests performed by manufacturer or a qualified testing agency holding NVLAP accreditation.

G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
1. Provide a list of all lamp types LED Modules and LED Drivers used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents citing lighting fixture types.
1. Lamps: 2 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

E. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.
   1. Obtain Architect's approval of luminaires in mockups before starting installations.
   2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Recessed Fixtures: Comply with NEMA LE 4.

E. Bulb shape complying with ANSI C79.1.

F. Lamp base complying with ANSI C81.61 or IEC 60061-1, where employing universal base or mount.

G. CRI of minimum 90. CCT of 3500 K.

H. L70 rated lamp life of 50,000 hours.

I. Lamps dimmable as indicated or 0.5 to 100 percent of maximum light output, via 0-10 VDC control signal or, where indicated, Digital Dimming Control Signal.

J. Field Replaceable driver.

K. Nominal Operating Voltage: Universal voltage 120 V ac or 277 V ac unless scheduled differently.
   1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

L. Housings:
   1. Hydroformed, cast or extruded-aluminum housing and heat sink suitable for the environment.
   2. Anodized or powder-coat finish.

2.3 LED LAMPS AND DRIVERS:

A. Minimum CRI Ra- 82 or as specified.

B. Lumen output shall be Luminaire Lumens or Delivered Lumens. Source lumens shall not be used.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. LED Rated life L70 of 50,000 hours per (IES LM-80). Luminaire shall maintain LED operating temperature to achieve this rating per TM-21.

E. Flicker: No visible or detectable flicker, operating on all dimmed intensities.

F. Dimming drivers shall be compatible with the control method shown on the drawings. All dimmed drivers shall use 0-10vdc control unless specified differently. Minimum level as scheduled.

G. Inrush current shall be reported and the lighting controls adjusted for inrush of LED product supplied.

H. THD: THD shall not exceed 80%.

I. Minimum driver efficiency shall be 83%.

J. LED module shall be replaceable in the field using modules with digitally traceable matching modules.

K. Luminaire shall be NRTL Listed at intended operating temperature.

L. Photometry shall be measured or absolute photometry. Derived or calculated photometry shall not be provided for consideration.

M. Approved Manufacturers- Drivers
1. General Electric.
2. Philips.
3. Osram / Sylvania.
4. Lutron
5. EldoLED
6. Thomas Research

N. Approved Manufacturers- LEDs
1. General Electric
2. Philips
3. Osram
4. Cree
5. Xicato
6. Nichia

O. Approved Manufacturers for Luminaires shall be as scheduled.

2.4 MATERIALS

A. Metal Parts:
1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to

prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Housings:
1. Hydroformed, cast or extruded-aluminum housing and heat sink suitable for the environment.
2. Anodized or powder-coat finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and line wattage. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp characteristics:
a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.5 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm).

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

2.7 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with LED light source and driver, including dimming driver.

1. Emergency Connection: Operate luminaire continuously at an output of 5 watts upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns driver/led module on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F with an average value exceeding 95 deg over a 24-hour period.
   b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F
   c. Humidity: More than 95 percent (condensing).
   d. Altitude: Exceeding 3300 feet

4. Battery: Sealed, maintenance-free, lead-acid type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports:
1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and repair.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

D. Flush-Mounted Luminaire Support:
1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

E. Wall-Mounted Luminaire Support:
1. Attached to structural members or approved backer plate in walls
2. Do not attach luminaires directly to gypsum board.

F. Ceiling-Mounted Luminaire Support:
1. Ceiling mount with four 5/32-inch- (4-mm) diameter steel wire or aircraft cable supports.
2. Ceiling mount with hook mount.

G. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 260943 "Relay-Based Lighting Controls."

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
   1. During adjustment visits, inspect all luminaires. Replace luminaires that are defective.
   2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 265613

LIGHTING POLES AND STANDARDS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Poles and accessories for support of luminaires.

1.3 DEFINITIONS

A. EPA: Equivalent projected area.

B. Luminaire: Complete lighting fixture.

C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

D. Standard: See "Pole."

1.4 ACTION SUBMITTALS

A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device, arranged as indicated.
   1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
   2. Include finishes for lighting poles and luminaire-supporting devices.
   3. Anchor bolts.

1.5 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For poles to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include pole inspection and repair procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.
   2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.
   3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design pole foundation and pole power system.

B. Structural Characteristics: Comply with AASHTO LTS-6-M.

C. Dead Load: Weight of luminaire and its horizontal and vertical supports, and supporting structure, applied according to AASHTO LTS-6-M.

D. Live Load: Single load of 500 lbf (2200 N) distributed according to AASHTO LTS-6-M.

E. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied according to AASHTO LTS-6-M for applicable areas on the Ice Load Map.

F. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.
   1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 100 mph (45 m/s).
      a. Wind Importance Factor: 1.0.
      b. Minimum Design Life: 25 years.
      c. Velocity Conversion Factor: 1.0.

G. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.

H. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 STEEL POLES

A. Source Limitations: Obtain poles from single manufacturer or producer.

B. Poles: Comply with ASTM A 500/A 500M, Grade B carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
   1. Shape: Square, straight.
   2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
   1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with galvanized-steel bolts.
   2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

E. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.

F. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces according to SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
   2. Powder Coat: Comply with AAMA 2604.
      a. Electrostatic-applied powder coating; single application and cured to a minimum 2.5- to 3.5-mils dry film thickness. Coat interior and exterior of pole for equal corrosion protection.
      b. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

C. Examine roughing-in for foundation and conduit to verify actual locations of installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete" and in addition use .

B. Special Pole Mounting Bracket: Where indicated, provide a non-ground mounted pole base. This shall be engineered and approved by the structure manufacturer, designed to support and hold the pole and luminaire intended. Submit information for this bracket and brace for approval.

3.3 POLE INSTALLATION

A. Alignment: Align poles as indicated.

B. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete" and in addition use finish free forms that leave no marks on the finished surface.

C. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.
   1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
   2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
   3. Install base covers unless otherwise indicated.
   4. Use a short piece of 1/2 -inch (13-mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

D. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.4 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

END OF SECTION

SECTION 265619
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

B. Related Requirements:
1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. 26 09 36 "Standalone Multipreset Modular Dimming Controls" for architectural dimming systems specified in Section 265100.
3. Section 260943 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
4. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of luminaire.

F. Luminaire: Complete lighting unit, including driver, LEDs, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.
1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.

4. LEDs, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type.
   a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
   b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
6. Wiring diagrams for power, control, and signal wiring.
7. Photoelectric relays.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

C. LEED Submittals:
   1. Product Data for Credit EA 5: For specified metering equipment.
   2. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit SS 8.1: Provide photometric proof of compliance with requirements.

D. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.

E. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of the following:
   1. Luminaire.
   2. Photoelectric relay.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Source quality-control reports.

F. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and photoelectric relays or motion sensors to include in operation and maintenance manuals.
   1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
   2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: ten for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
   4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

E. Mockups: For exterior luminaires, complete with power and control connections.
   1. Obtain Architect's approval of luminaires in mockups before starting installations.
   2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including luminaire support components.
      b. Faulty operation of luminaires and accessories.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d.
   2. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
   1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event.

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598 and listed for wet location.

E. Single piece die-cast aluminum housing. Nominal wall thickness of 0.125”. Cast or extruded doorframe, extruded silicon gasket, stainless steel latch and hinges. Flat tempered glass lens. Heatsink sufficient to operate the LEDs and Drivers within rated temperature with 20% headroom at 25 degree C ambient.

F. Optics shall be a molded prism or lens associated with each individual LED. Provide light distribution pattern specified. Provide absolute photometry of this luminaire head. 0.0% uplight > 90 degrees.

G. LEDs shall be securely mounted to heavy duty metal core circuit board to operate the individual LEDs within manufacturer’s ratings. LED mounting circuit board shall form an individually replaceable module. Minimum CRI of 67 unless scheduled otherwise.

H. Driver shall be individually replaceable. Voltage as shown on the schedule. Maximum drive current is 700 ma. Power factor >90% THD < 20%. Surge suppression shall comply with ANSI/IEEE C62.41-1991, 6kV/3kA B3. Local photocell or control equipment as shown on the schedule. LED LAMPS AND DRIVERS:

I. Minimum CRI Ra- 82 or as specified.

J. Lumen output shall be Luminaire Lumens or Delivered Lumens. Source lumens shall not be used.

K. Color Consistency 4 MacAdams Ellipse or better.

L. LED Rated life L70 of 50,000 hours per (IES LM-80). Luminaire shall maintain LED operating temperature to achieve this rating per TM-21.

M. Flicker: No visible or detectable flicker, operating on all dimmed intensities.

N. Dimming drivers shall be compatible with the control method shown on the drawings. All dimmed drivers shall use 0-10vdc control unless specified differently. Minimum level as scheduled.

O. Inrush current shall be reported and the lighting controls adjusted for inrush of LED product supplied.

P. THD: THD shall not exceed 80%.

Q. Minimum driver efficiency shall be 83%.

R. LED module shall be replaceable in the field using modules with digitally traceable matching modules.

S. Luminaire shall be NRTL Listed at intended operating temperature.

T. Photometry shall be measured or absolute photometry. Derived or calculated photometry shall not be provided for consideration.

U. Approved Manufacturers- Drivers
   1. General Electric.
   2. Philips.

3. Osram / Sylvania.
4. Lutron
5. EldoLED
6. Thomas Research

V. Approved Manufacturers- LEDs
1. General Electric
2. Philips
3. Osram
4. Cree
5. Xicato
6. Nichia

W. Approved Manufacturers for Luminaires shall be as scheduled.

X. In-line Fusing: Separate in-line fuse for each luminaire.

Y. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum or Stainless steel. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:
1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch ((3.175 mm)) minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:
1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp characteristics:
      a. "USE ONLY" and include specific lamp type.
      b. Lamp diameter, shape, size, wattage and coating.
      c. CCT and CRI for all luminaires.

2.4 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
   3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
   4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
      a. Color: As Scheduled, provide swatch for approval.

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
   2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
      a. Color: As selected from manufacturer's standard catalog of colors.
      b. Color: Match Architect's sample of manufacturer's standard color.
      c. Color: As selected by Architect from manufacturer's full range.

2.5 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports and similar accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, and canopy ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:
1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:
1. Attached to structural members in walls or attached to a minimum 1/8 inch (3 mm) backing plate attached to wall structural members in wall.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device and motion sensor to prevent false operation of relay by artificial light sources, favoring a north orientation.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Verify operation of photoelectric controls.

C. Illumination Tests:
   1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
      a. IES LM-5.
      b. IES LM-50.
      c. IES LM-64.
      d. IES LM-72.
   2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and accessories

3.9 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to a two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
   1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
   2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 270000
General Common Conditions For All Communications Sections

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, and other documents as designated, apply to this Document.

B. See additional requirements in Division 7 and section 270100 Part 3.

1.2 RELATED SECTIONS

A. Specifications throughout all Divisions of the Project Manual are directly applicable to this section, and this section is directly applicable to them.
   1. All Division 27 Sections
   2. Requirements of the following Division 26 sections apply to this section
      a. Basic electrical requirements
      b. Basic electrical materials and methods
      c. Grounding, earthing, and bonding
   3. Division 21 Fire Suppression
   4. Division 22 Plumbing
   5. Division 23 HVAC
   6. Division 28 Electronic Safety and Security

1.3 SUMMARY

A. The work on many processes in this section is not part of the Division 27 contract. In their proposals, the respective trades shall include portions and administration topics applicable to all Division 27 Sections.

B. This document is based upon the 2018 Construction Specification Institute (CSI) Master Format numbers and titles for sections within Division 27: Communications.

C. Where IT or Owner representation is stipulated in this Division, the Data Center Operations Infrastructure Cabling team shall provide it.

1.4 SUBMITTALS

A. Product data shall be supplied for any parts or equipment that do not match the specified part number.

B. Shop drawings
   1. Labeling schedules and layouts in owner-designated electronic format
   2. Cabling administrative drawings

1.5 CONDITIONS

A. Drawings and General provisions of the contract, including Uniform General Conditions, Supplementary General Conditions, architectural plans and specifications, requirements of Division 1, electrical, mechanical, plumbing, audio visual, security, and telecommunications specifications and plans, apply to the communications section. They shall be considered a part of this section. The contractor shall read all sections in their entirety and apply them as appropriate for work in this section.

B. A kick-off meeting should be held to coordinate the tray installation and set expectations before starting installation. The General Contractor should organize this meeting, which must include representatives from the following trades: FP&D, Electrical (Division 26), Structured Cable, Nurse Call, Paging, Building Automation and Control, Plumbing, HVAC, Fire Sprinkler, Framing, and any other relevant trades. The Data Center Operations Infrastructure Cabling Team will lead the meeting.

C. Conflicts:
   1. Drawings and specifications will be used in conjunction with and supplement one another. Generally, the drawings determine the nature and quality of the installation, including the materials and tests. The quantities are derived from the drawings, details, listings, and manufacturer's directions.
      a. Final order counts and distances are the contractor's responsibility.
   2. If there is an apparent conflict between the drawings and specifications, or between specification sections, the items with the greater quality or quantity shall be submitted, estimated, and installed.
   3. Clarification with the Owner and/or the owner's representative regarding these items shall be made before ordering and installation.

D. Owner / Contractor
   1. The Architect/Project Manager will submit an appropriate scope of work that allows the contractor to plan and bid on the project accordingly.

E. Contractor
   1. Furnish all labor, materials, tools, equipment, and services for the installation described herein. Provide add/deduct unit pricing for all components as part of the bid response. Base fixed price add/deduct units on an average cable length of 175 linear feet.
   2. The Contractor shall procure and maintain insurance against claims for the duration of this agreement.
   3. Use of Subcontractors: The Successful bidder shall inform the Owner's contact and/or General Contractor in writing about the intention to use Subcontractors and the scope of work for which they are being hired. The Owner or the owner's designated contact must approve the chosen Subcontractors in writing before the subcontractor's hiring and the start of any work. The low-voltage Subcontractor must be approved and certified. Refer to the listing in Appendix 7.
   4. Use of Subcontractors: The Contractor's designated project manager will be recognized as the single point of contact. The Project Manager shall oversee all work performed to ensure compliance with the specifications outlined in the bid documents (which include all specifications and drawings) to ensure quality installation.

1.6 SCOPE OF WORK:

A. This establishes a communications infrastructure to be used as signal pathways for voice, high-speed data transmission, and other low-voltage services. Contractor shall:
   1. Comply with all Master Specifications documents and the following requirements for a complete project installation.
   2. Provide a structured cabling system as described hereafter that includes, but is not limited to, supplying, installing, labeling, and testing fiber backbone, fiber and voice riser cable; data copper, fiber, and voice copper horizontal cabling; cable connectors, communications outlets and terminations, patch cables, and equipment racks/cabinets for networking hardware and patch panels.
   3. All requirements and specifications will be enforced. Cable pathways and runs to individual outlets are not shown in their entirety; however, they shall be provided as if shown in their entirety.

4. Coordinate with electrical tradespersons to verify that conduit routing does not cause cabling to exceed allowable link length.
5. Follow industry-standard installation procedures, including the BICSI Installation Standard and guidelines, as well as specified manufacturers' standard recommended procedures and installation practices for communications cables, to ensure that this cable plant and equipment maintain their mechanical and electrical transmission characteristics.
6. An approved, certified installer shall perform the Division 27 work.
7. The low-voltage communications Subcontractor shall complete non-concealed work.

1.7 REFERENCE STANDARDS:

A. The latest published edition of a reference shall apply to this Project unless identified by a specific edition date.

B. All reference amendments adopted before the effective date of the Contract shall apply to this Project.

C. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.

D. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean reference to the latest printed edition of each in effect at the date of contract.

E. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation, and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed in Appendix 04.

1.8 DEFINITIONS:

1. Definitions and Abbreviations are listed in Appendix 05:

PART 2 - PRODUCTS

2.1 PRODUCTS AND WORK NOT INCLUDED BY DIVISION 27

A. Others shall separately purchase and/or provide certain equipment and miscellaneous items that will be installed during the installation process. Such items may not be indicated in the documents. Contractor shall coordinate with the Owner and his suppliers when considering:
   1. Provision and installation of phone systems, computer hardware, and related networking software and equipment.
   2. Provision and installation of multi-port routers and hubs in communications rooms.
      a. The owner provides TEC/TDR UPSs.
   3. Communications grounding bus bars and grounding wires connecting to the main building electrode system by Division 26.
   4. Dedicated power panels, ground bus bars, circuits, and utility outlets.
   5. Installation and finishing of fire-rated plywood backboards.
   6. Building mechanical ductwork, cooling/heating system, and environmental control sensors.
   7. Communication pathway devices such as conduits, conduit sleeves, back boxes, and penetrations in walls and floors. Including, but not limited to, concealed work, office spaces, and open areas.
   8. Provision and installation of modular furniture and millwork.

PART 3 - PENETRATIONS

3.1 THE WORK IN THIS SECTION IS IN DIVISION 7 CONTRACT AND VERIFIED COMPLETE AT PROJECT TURNOVER.

A. Wall Penetrations - Fire - Smoke – Sound
   1. All fire, smoke, and sound wall penetrations must be correctly made to protect the safety of patients and employees. A facility is designed, architected, and built with fire integrity that must not be compromised as the building is modified over its lifetime.
   2. The items listed often penetrate 1—and 2–hour fire-resistance-rated (FRR) assemblies. The requirements for filling the space between the item in question and the wall are in NFPC 101® Section 8.2.3.2.4.2. The option is to either fill the space with appropriately rated fire-stop material or protect the space with an approved device designed to maintain the wall's fire resistance.
   3. If a sleeve is used around the item that traverses the wall, it must be installed into the wall without any opening between it and the wall. The open space within the sleeve must then be filled with an appropriately rated fire stop.

B. All items listed in 1 through 2 must have penetrations in fire-resistance-rated assemblies filled to maintain the integrity of the fire barrier.
   1. Conduits
      a. When a conduit passes through a wall that is either rated or must be fire-stopped due to the compartment's lack of sprinklers, it is essential to fill any gap around the conduit as described above.
   2. Cables/Wires
      a. Sometimes cables or wires are passed through a penetration contained in a firewall as a single installation. This often occurs in healthcare organizations with communication cables. Even in these cases, the penetration must be patched appropriately.
   3. NOTE: Local and state building codes also govern fire, smoke, and sound wall penetrations.
   4. NOTE: This requirement applies to all departments, organizations, employees, and/or vendors who perform structured cable work in the facilities for:
      a. Telephony and Computer networks, fire, smoke and sound wall penetrations, alarm systems, security systems, HVAC Control or sensors, patient entertainment systems, announcing systems, nurse call, telemetry, RFID, etc.
   5. NOTE: While this document is written specifically for low-voltage wiring, the JCAHO standards apply to any fire or smoke wall penetration. As you work in the facility, if you note any existing penetrations that are not up to standard, please immediately notify the construction Project Manager.
   6. While Facility Engineering has overall responsibility, each department, organization, employee, and/or vendor is responsible for following the process to obtain a permit from Facility Engineering before work commences and for adhering to the guidelines to maintain the fire/smoke wall integrity.

C. Process:
   1. NOTE: This process applies to all individuals, groups, and vendors performing low-voltage cable installations at any Intermountain facility or clinic.
      a. Fire/Smoke Walls
         1) Any Vendor, department,/or person needing to do any cable work that involves wall penetrations, adding to existing or new, is required to obtain a “Low Voltage Cable Work Permit” from the Facility Engineer.
      b. Above Ceiling Work
         1) Any vendor, department, or person needing to perform cable work above ceiling tiles, including adding to existing or new ones, must obtain all necessary permits.

c. Above Ceiling Permit to be obtained from Facilities Management
   1) The permit requires detailed information regarding the work being done and the location where it will be performed. The permit will also state the current approved sealing compound for the facility and specific requirements for conduits.
   2) Specific rules governing the conduct of work in certain areas of the hospital may also exist. NOTE: Sealing products from different manufacturers cannot be used in the same penetration. Therefore, if an additional cable is added to an existing penetration and you don't have the same brand of caulk, you must remove all of the caulk and redo the seal completely.
d. ICRA Permit to be obtained from the Infectious Preventionist
e. Hot Work Permit to be obtained from Facilities Engineer

2. Quality of Work
   a. Facility Engineering Orientation

3.2 MEASUREMENT PROCEDURES:

A. The Contractor shall
   1. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.
   2. Verify dimensions in installation areas through field measurements before fabrication and indicate the measurements and scale on the shop drawings.
   3. Coordinate the fabrication schedule with construction progress to avoid delays in the work.
   4. Where field measurements cannot be made without delaying the work, establish dimensions and coordinate with the General Contractor.
   5. When approved, proceed with fabricating units without field measurements.

3.3 CHANGES

A. ALTERNATES:
   1. If an alternate material is proposed that meets or exceeds the specified requirements, the Contractor shall provide the manufacturer's specifications in writing to the Owner for approval before purchase and installation.
   2. Substitutions of material by the Contractor shall be in writing, complete with written manufacturers' specifications. The material substituted shall not void, alter, or change the manufacturer's structured cabling system warranty.
   3. Contractor shall:
      a. Provide a complete cabling infrastructure per these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing.
      b. Promptly respond to these changes with a complete material list, including pricing and labor, in writing, and present it to the Owner for approval. Also include unit pricing.
      c. Do not proceed with any additional scope of work without a signed approval by the Owner.
   4. The Owner will not pay for the Contractor's additional work without signed approval of these changes. The contractor will submit a copy of the signed change order upon billing.
   5. The Owner's Infrastructure Cable team will be the final judge of acceptability, with review by the Owner's Representative and acceptance distributed by the Architect. No substitute shall be ordered, installed, or utilized without the Architect's prior written verification of acceptance from the Owner's Infrastructure Cable team.

B. SUBSTITUTION PROCEDURES
   1. Substitution may be considered when a product becomes unavailable through no fault of the Contractor.
   2. Document each request with complete data substantiating that the proposed substitution complies with the Contract Documents. Include in each request for substitution:

a. Product identification, manufacturer's name, and address.
b. Product Data: Description, performance and test data, reference standards, finishes, and colors.
c. Samples: Finishes
d. Complete and accurate drawings indicating construction revisions required (if any) to accommodate substitutions.
e. Data relating to changes required in the construction schedule.
f. Cost comparison between specified and proposed substitution.

3. Substitutions indicated or implied on shop drawings or product data submittals will not be considered unless a separate written request is submitted or when acceptance would require revision to the Contract Documents.
4. The Owner will be the final judge of acceptability, with the Owner's Representative reviewing the proposal and the architect distributing the acceptance.
5. No substitute shall be ordered, installed, or utilized without the Architect's prior written verification of acceptance from the Owner's Infrastructure Cable team.

PART 4 - EXECUTION

4.1 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Contractor shall supply all city, county, and state telecommunication cabling permits required by the appropriate governing agency.
2. Before commencing work, the Contractor and staff shall obtain all required Intermountain Healthcare permits, including, but not limited to, facility sign-in permits, ceiling work permits, hot work permits, and confined space permits.
3. The contractor shall be city, county, and state-licensed and/or bonded as required for communications/low-voltage cabling systems work.

B. Certifications:
1. At the time of bid submission, the contractor shall submit an up-to-date and valid certification verifying the qualifications of the Contractor and installers to perform the work specified herein.
2. Contractor shall have a complete working knowledge of low-voltage cabling applications, such as, but not limited to, data, voice, and video network systems.
3. The contracting firm shall have installed similar-sized systems in at least ten (10) other projects in the last five years before this bid and be regularly engaged in installing the types of systems specified in this document. Certification shall include, but is not limited to, items such as the name and location of project contacts and numbers, total square footage, total number of cables/drops, types of media, etc.
4. Contractor shall provide certificates for the appropriate insurance coverage as defined in the contract documents.
5. A qualification document shall list all installer personnel assigned to this project.
6. Fifty percent of the personnel working on the job site shall have a minimum of three years' experience in installing the types of systems, equipment, and cables specified in this document. Before commencement of work, any personnel substitutions shall be noted in writing to the Owner's Data Center Operations Infrastructure Cabling representative.
7. BICSI ITS Cabling Installation Program Installer Level 1 or 2 or Technician certifications may be substituted in lieu of the 3-year requirement. All cabling installers shall be trained and certified by the cable manufacturer to install and maintain communication cabling.
8. Refer also to General Conditions.

C. Administrative Requirements and Coordination:

1. The Contractor shall:
   a. Ensure that all technicians performing work have obtained badge access at least 48 hours before the scheduled start.
   b. Provide a specified contact person (name and contact number) to coordinate attendance at project meetings with the communication consultant, the Owner, and others.
   c. Coordinate work of this section with the Owner's system specifications, workstations, equipment suppliers, and installers.
   d. Coordinate installation work with other crafts (e.g., ceiling grid contractors, HVAC, and sheet metal contractors) under the direction of the General Contractor to resolve procedures and installation placement for cable trays and cable bundle pathways. The goal of this coordination will be to establish priority pathways for critical data and voice network cable infrastructure, materials, and associated hardware, while mitigating project delays and allowing service access for communications and HVAC components. Damage by the Contractor to the craftwork of others will be remediated at the Contractor's expense in a timely manner.
   e. Exchange information and agree on details of equipment arrangements and installation interfaces. Record agreements are reached in meetings, and the record is distributed to other participants, the owner, and the communication consultant.
   f. Arrangement, layout, and locations of distribution frames, patch panels, and cross-connect blocks in equipment rooms and racks to accommodate and optimize the arrangement and space requirements of any service provider equipment, telephone system, and LAN equipment as directed by Data Center Operations. Tasks shall be coordinated with the Owner's Data Center Operations team and representatives from other trades' installations.
   g. Where installed, confirm exact locations and method of mounting outlets in modular furniture. Follow furniture manufacturers' instructions for installing cable and devices in modular partitions. Obtain modular furniture and power pole locations from the General Contractor. Wiring locations noted in plans along walls for modular furniture are approximate and will have to be determined by the Contractor at the time of installation. Field condition adjustments for installation may be necessary, and coordination efforts with the mechanical and electrical contractor for the pathway must be initiated early in the project to comply with the maximum 40% conduit fill factor requirements.
   h. When requested by the Owner or the Owner's representative, furnish extra materials that match specified products, are factory packaged with protective covering for storage, and are identified with labels describing contents. Unit pricing shall apply.

D. Contract Administration:
   1. Change orders, complete with a price breakdown and description, shall be submitted to the owner/project manager for approval before any work is commenced.
   2. The Owner's Data Center Operations Representative will provide job field reports upon inspection of the Contractor's installation, materials, supporting hardware, coordination with other trades, and progress to schedule to the Owner's project manager.
   3. Job Field Report outline:
      a. General installation progress in relation to scheduled work made by the Contractor up to that date.
      b. The Contractor will correct all deficiencies noted in the cable installation.

E. Pre-Installation Meetings - Contractor shall:
   1. Attend and/or arrange a scheduled pre-installation conference before beginning any work in this section.

a. Agenda: This venue is for asking and clarifying questions in writing related to work to be performed, scheduling, coordination, etc., with the consultant, project manager, and/or Data Center Operations Infrastructure Cabling representative.
b. Attendance: The communications project manager/supervisor shall attend meetings arranged by the General Contractor, the Owner's Data Center Operations Infrastructure Cabling representatives, and other parties affected by the work of this document.
c. All individuals who will be installers of communication cables and equipment in an on-site supervisory capacity shall be required to attend the pre-installation conference. Individuals who do not attend the conference will not be permitted to supervise the installation of, or install, terminate, or test communications cables on the project. This includes supervisors, project managers, and lead installers of this project.

F. Request for Change (RFC)
1. The Change Approval Board shall open and approve a Request for Change before any modifications, attachments, or other activities that may affect production systems.
a. Policy and details available through the Data Center Operations Infrastructure Cable Representative.

G. Post-Installation Meetings:
1. Schedule Div. 27 Final Inspection
2. At the time of substantial completion, or shortly thereafter, the low-voltage Sub-Contractor shall call and arrange for a post-installation meeting to present and review all submittal documents, including, but not limited to, as-built drawings, test reports, warranty documentation, and other relevant documents. Attendees shall be Owner staff, Owner's Representative, General Contractor, and others that the General Contractor deems appropriate.
3. At this meeting, the Contractor shall present and explain all documentation, including test results, and ask for feedback on its completeness. Any discrepancies or deviations noted and agreed to by participants shall be remedied by the Contractor and resubmitted within one week of the meeting.

4.2 DELIVERY, STORAGE, AND HANDLING:

A. Coordination with delivery companies, drivers, site address, and contact person(s) will be the responsibility of the Contractor.

B. Contractor Shall:
1. Ensure prompt material deliveries to meet the contracted completion date.
2. Coordinate deliveries and submittals with the General Contractor to ensure a timely installation.
3. No equipment materials shall be delivered to the job site more than three weeks prior to the commencement of its installation.
4. Equipment shall be delivered in original packages with intact labels and clearly marked identification.
5. Materials shall not be damaged in any way and shall comply with the manufacturer's operating specifications.
6. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged before system acceptance shall be replaced at no cost to the Owner.
7. The Material Contractor shall be responsible for all handling and control of equipment.
8. The Material Contractor is liable for any material loss due to delivery and storage problems.

C. Owner/General Contractor shall supply a list of security requirements for the Contractor to follow.

4.3 PROJECT/SITE CONDITIONS

A. For all environmental recommendations, refer to the master Architectural section.

B. For all security recommendations, refer to related Division 01.

C. After completing system installation, including outlet fittings and devices, inspect the exposed finish. The contractor will remove burrs, dirt, and construction debris. If applicable, the Contractor will repair damaged finishes, including chips, scratches, and abrasions, to restore the original appearance.

D. Contractor shall provide a clean work environment daily, free from trash/rubbish accumulated during and after cabling installation.

E. Food and drink are not permitted in work areas. They shall be stored, prepared, and consumed only in designated break or cafeteria areas.

F. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, and tiles. If any liquid or other detrimental (cuts, soils, stains, etc.) damages the above finishes, Contractor shall provide professional services to clean or repair scratched/soiled finishes, at Contractor's expense.

4.4 CLEANING

A. Work areas will be kept in a broom-clean condition throughout installation.

B. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been performed daily, unless designated for storage.

C. The Contractor will damp clean all surfaces before final acceptance by the Owner.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 270100
Operation And Maintenance of Communications Systems

PART 1 - GENERAL

1.1 INTRODUCTION

A. To make the approval of such a large topic possible, the structured cable topic has been broken into its subcomponents, and each subcomponent was completed, reviewed, and approved in turn. The result is that this comprehensive guideline should provide adequate guidance on this topic.

PART 2 - PRODUCT

2.1 KEY POINTS

A. Category 6A shielded foil over unshielded twisted pair (F/UTP) is the only approved standard for cabling.
   1. Specifically, for all Intermountain health properties, Siemon category CAT6A F/UTP (foil over unshielded twisted pair) cable and associated patch panels, wall plates, and jacks.
   2. Only Siemon-certified contractors or certified Intermountain Health cable technicians will install structured cable at Intermountain Health facilities.

2.2 IMPLEMENTATION

A. This guide is for New Construction and Remodels. These standards will be implemented over time in existing cabling environments as rework is performed.

B. If servers need to be connected at 10GBaseT and copper is the only option, CAT6A F/UTP is required. New Server connections shall be a minimum of OS1 Single Mode Fiber.

C. Installations already in place do not require removing or replacing existing CAT5e or newer cabling. All new cabling shall follow the recommendation to use CAT6A F/UTP cabling.

2.3 STANDARD PRODUCT

A. The approved cable type for horizontal cabling is CAT 6A F/UTP.
   1. The Approved Standard Manufacturer for Intermountain Health's horizontal cabling is:
      a. Siemon Company USA
      b. 101 Siemon Company Drive
      c. Watertown, CT 06795
         1) Approved Suppliers of Siemon cable, patch panels, jacks, and parts are listed in Appendix 06:

PART 3 - EXECUTION

3.1 HORIZONTAL CABLING

A. Horizontal Subsystem is the portion of the cabling system that extends from (and includes) the work area telecommunications outlet/connector to the Floor Distributor (FD)/Horizontal Cross-connect (HC) in the telecommunications room (TDR). It consists of the communications outlet/connector, the horizontal cable, an optional consolidation point, and that portion of the cross-connect in the telecommunications room serving the horizontal cable. Each building floor should be served by its own Floor Distributor/Horizontal (FD/HC) Subsystem in the Telecommunications Room (TDR).

1. NOTE: Cable installers have rigorous requirements to be certified for Siemon cables and products. Validation of certification is required before accepting a bid.
2. Current Siemon Approved/Certified Cable Installers for the Siemon Network are listed in Appendix 07.

B. The horizontal cabling system's reliability is critical to the operation of IS equipment throughout a facility. Installing the cable is highly labor-intensive, and several learned skills are needed to install it correctly. Cable installers are certified; to be certified, installers must demonstrate the ability to install the cable correctly. If the cable is installed by a certified installer and is installed in accordance with the manufacturer's guidelines, the manufacturer will warranty the cable installation.

C. The manufacturer also requires the cables to be individually labeled and 100% tested and certified. Cable testing and certification equipment is usually expensive and not commonly available at the facility or by many telecom installers. The manufacturer requires Certified Installer companies to be knowledgeable in using "Qualified" Field Testing equipment and provide test results for warranty registration.
   1. The contractor is to verify the current "Qualified" tester manufacturers and the current operating software with the manufacturer.
   2. Upon completion, contractors will provide Intermountain Health with test results in the operating software format (not PDF, text, or Word).

D. Much of the cable is installed in walls and the ceiling and usually lasts the lifespan of the building. Like most technology, cable's lifespan is its usability and applicability to future computing technology.

END OF SECTION

SECTION 270113
Warranty, Product, and System

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the listing found in Section 270000.

PART 2 - PRODUCTS

2.1 STANDARD WARRANTY

A. The contractor shall provide a minimum one (1) year warranty on installation and workmanship, PLUS an Extended Product Warranty and System Assurance Warranty for this wiring system, and shall commit to making available local support for the product and system during the Warranty period.

B. System Certification: Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a Manufacturer's Warranty certificate.

C. A permanent link or channel model configuration may be applied to the structured cabling system's horizontal and/or backbone sub-systems. Application assurance is only applied to a channel model configuration. All channels must be qualified for linear transmission performance up to 500 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.

2.2 EXTENDED WARRANTY

A. The manufacturer of passive telecommunications equipment used in a manner not associated with the Systems Warranty must have a minimum five (5) year Component Warranty on all its products. The Product's Warranty covers the components against defects in material or workmanship under normal and proper use.
   1. Special Project Warranty: A full end-to-end written warranty mutually executed by the manufacturer and the principal Installer, agreeing to replace and install voice/data distribution system components that fail in materials or workmanship, or do not meet the manufacturer’s official published specifications and performance criteria within the special Project warranty period specified below. This shall cover applications assurance, cable, and connecting hardware, including labor and materials. This warranty shall be in addition to, and not a limitation of, other rights and remedies the Owner may have against the Contractor under the Contract Documents.

B. A twenty-five (25) year warranty available for the Category 6A Z-MAX copper structured cabling system shall be provided for an end-to-end channel model installation, which covers applications assurance, cable, connecting hardware, and the labor cost for the repair or replacement thereof. The fiber warranty will be an XGLO twenty-five (25) year warranty, which is based on using laser-optimized single-mode fiber as a minimum.
   1. Performance claims based on worst-case testing and channel configurations.

2. Special Project Warranty Period: 25 years minimum, beginning on the date of Substantial Completion.
3. Siemon Certified Warranty Requirements:
   a. Upon the project's completion, Intermountain Health must receive the Full Warranty Documentation from The Siemon Company before final retention funds are released to the general contractor, electrical contractor, and structured cabling subcontractor, if applicable.

2.3 MAINTENANCE

A. Support Availability: The Contractor shall commit to making available local support for the product and system during the Warranty or Extended Warranty period.

END OF SECTION

SECTION 270119
Field Testing and Reporting

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the listing found in Section 270000.

1.2 SYSTEM DESCRIPTION

A. The owner reserves the right to be present during any or all testing.

B. The objective of this project is to provide a complete communications cabling infrastructure system installation including, but not limited to fiber backbone, riser system, horizontal data and voice cabling with associated terminations, mounting equipment, cable pathway and management systems, testing and other items/materials, as specified in drawings, these specifications, and contract documents.

C. The Contractor's BICSI Registered Communications Distribution Designer (RCDD) supervisor shall review, approve, and stamp all documents before submitting. The Contractor's RCDD shall warrant in writing that 100% of the installation meets the requirements specified herein upon completion of all work.

D. Product Certificates shall be signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.

E. Upon completion of testing the installed system, the contractor shall submit the required field test reports in the specified format and media.

F. The contractor shall deliver the manufacturer's signed long-term warranty for the installed cabling system, including all components that comprise the complete cabling system. Delivery will be affected within two weeks of the final punch list review. Failure of any component to pass system component tests shall be promptly corrected, repaired, or replaced to meet standards compliance.

1.3 PREFERRED OWNER INSPECTION & TEST CHECKPOINTS

A. DCO & ICT Inspection Milestones and responsibilities need to be coordinated into the master project plan to allow the GC to make timely arrangements. All are per floor and/or phase.
   1. ICT & DCO = Framing, during and/or after boxes & conduits are in place, prior to sheetrock.
   2. ICT = When the cable basket is starting to be installed.
   3. ICT = When the cable basket is ready, but before pulling the cable.
   4. ICT & DCO = When TDRs are ready for racks and ladders.
   5. DCO = When anchoring racks and laying out equipment.
   6. ICT & DCO = When the TDR environmental requirements are ready, the room must be dust-free and secure. See the attached TDR checklist.
      a. The TEC and TDRs must be high on the build timeline and be completed early in the construction to accommodate the building systems to be tested and commissioned, such as BAS, Security, and Wireless Network.
   7. ICT = When trim and testing are in progress.
   8. OTHERS

a. Depending on the project, the manufacturer will inspect 1 or 2 times.
b. DCO or ICT = When problems or questions arise.

PART 2 - PRODUCTS

2.1 SITE TESTS & INSPECTIONS

A. Before pulling the cable, the cabling contractor shall schedule an inspection of the pathways with a member of the Data Center Operations Infrastructure cabling team.

B. The contractor shall test the communications infrastructure system upon completion, including all pathways and grounding.
   1. Before testing, the Cables and termination modules shall be affixed, mounted, or installed to the designed/specified permanent location.
   2. Any removal and reinstallation of any component in a circuit, including faceplates, requires retesting of that circuit and any other disturbed or affected circuits.
   3. Approved instruments, apparatus, services, and qualified personnel shall be utilized.
   4. If tests fail, Contractor shall correct as required to produce a legitimate passing test.
   5. Manipulating tester parameters on a failing test to achieve a passing test is unacceptable.

C. These specifications will be strictly enforced. The Contractor must verify that the specifications' requirements are fully met through testing with an approved tester (rated for testing the cable type in use) and documentation as specified below. This includes confirmation of requirements by demonstration, testing, and inspection. A demonstration shall be provided in soft copy at the final walk-through.

D. Before installation, the contractor must notify the owner of the likelihood of a cable exceeding standardized lengths. Without the owner’s written approval and prior written notice, testing that shows some or all pairs of cable not meeting specifications shall be replaced at the Contractor’s expense (including respective connectors).

E. Testing is still required for non-compliant cabling. The tests shall be for wire-mapping, opens, cable-pair shorts, and shorts-to-ground. The test results must be within acceptable tolerances and shall be submitted with the Owner’s acceptance document.

2.2 CABLE TESTING PLAN

A. The Contractor shall:
   1. Before beginning cable testing, provide a complete and detailed test plan for approval of the cabling system specified herein, including a complete list of test equipment for copper and fiber optic components and accessories. The following minimal items shall be submitted for review:
      a. All testing methods that clearly describe procedures and methods.
      b. Product data for test equipment
      c. Certifications and qualifications of all persons conducting the testing.
      d. Calibration certificates indicate that equipment calibration meets National Institute of Standards and Technology (NIST) standards and has been calibrated at least once in the previous year of the testing date.
   2. Include validation and testing. The owner will require that the telecommunications cabling system installed by the Contractor be fully certified to meet all necessary requirements to comply with referenced IEEE and TIA specifications and the vendor’s warranty.
   3. The source/cause of test failure readings will be determined, and the malfunctioning component and/or workmanship within each channel or permanent link will be corrected. A retest will be performed to demonstrate compliance until the corrected failure produces a passing result.

2.3 CABLE TESTING REPORTS

A. The Contractor shall submit cable test reports as follows:
   1. Submit certified test reports of Contractor-performed tests.
      a. The tests shall clearly demonstrate that the media and its components fully comply with the requirements specified herein.
      b. (1) A set of electronic test reports shall be submitted and clearly identified with cable identification.

PART 3 - EXECUTION

3.1 TEST EQUIPMENT

A. All transmission testing of balanced twisted-pair cables shall be performed with an approved Level III balanced twisted-pair tester found on the Siemon Ally Website. The latest version of the software shall be installed before conducting testing. Refer to the Siemon Warranty Documents for proper testing requirements of associated cables and components.

B. All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review before the start of testing

C. Auto test settings provided in the field tester for testing the installed cabling shall be set to the default parameters

D. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

3.2 TEST METHOD / CRITERIA

A. Copper Testing
   1. Testing all newly installed cable channels shall be performed before system cutover.
      a. Visually inspect F/UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA/EIA-568-C.1.
      b. Visually confirm Category 6A marking of outlets, cover plates, outlet/connectors, and patch panels.
      c. Visually inspect cable placement, cable termination, grounding and bonding, equipment, patch cords, and labeling of all components.
      d. Test F/UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test the operation of shorting bars in connection blocks. Test cables after termination, but not cross-connection.
      e. Test instruments shall meet or exceed the applicable requirements in TIA/EIA-568-C and those required by the manufacturer to validate and start the warranty.
   2. Copper Testing all 500 MHz category 6A field-testing shall be performed with an approved level 111e balanced twisted-pair field test device, that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex (Level IIe or IIIe balanced twisted pair field test device). Use only test cords and adapters qualified by test equipment manufacturers for channel or link test configuration.
   3. All installed 500 MHz category 6A channels shall perform equal to or better than the minimum requirements as specified below:
      a. Category 3 balanced twisted-pair backbone cables, for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-C.1. Test parameters include wire map plus

F/UTP (ScTP) shield continuity (when present), insertion loss, length, and NEXT loss (pair-to-pair). NEXT testing shall be done in both directions.

b. 500 MHZ Category 6A balanced twisted-pair horizontal and backbone cables shall be 100 percent tested.

4. F/UTP Performance Tests
   a. Wire map.
   b. Length (physical vs. electrical, and length requirements)
   c. Insertion loss
   d. Near-end crosstalk (NEXT) loss
   e. Power sum near-end crosstalk (PSNEXT) loss
   f. Equal-level far-end crosstalk (ELFEXT)
   g. Power sum equal-level far-end crosstalk (PSELFEXT)
   h. Return loss
   i. Propagation delay
   j. Delay skew
   k. F/UTP Shield continuity
5. Final Verification Tests: Verification tests for F/UTP systems are performed after the complete communications cabling and workstation outlet/connectors are installed.
6. Document data for each measurement. Data for submittals shall be printed in a summary report.
7. End-to-end cabling will be considered defective if it does not pass tests and inspections.
8. Prepare and submit test and inspection reports.

B. Horizontal Fiber Testing
   1. Fiber horizontal cables shall be 100% tested for insertion loss and length.
   2. Insertion loss shall be tested at 850 nm or 1300 nm for 50/125µm and 62.5/125µm multimode cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
   3. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.
   4. The horizontal link performance guarantees are based on an optical fiber calculation for the appropriate fiber solution. Optical fiber calculations shall be determined using the Siemon Fiber Loss Calculator on the Siemon Ally Website.

C. Backbone Fiber Testing
   1. Fiber backbone cables shall be 100% tested for insertion loss.
   2. Insertion loss shall be tested at both 850 nm and 1300 nm for 50/125µm and 62.5/125µm multimode cabling and at both 1310 nm and 1550 nm for 8.5/125µm single mode cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
   3. Insertion loss shall be tested at 1310 and 1550 for single-mode cabling in at least one direction using Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-7.
   4. Length shall be tested using an OTDR, optical length test measurement device, or sequential cable measurement markings.
   5. The backbone link performance guarantees are based on an optical fiber calculation for the appropriate fiber solution. Optical fiber calculations for any fiber cable greater than 90m (295 ft.) shall be determined using the Siemon Fiber Loss Calculator found on the Siemon Ally Website.

3.3 DEMONSTRATION

A. Include training for appropriate IT staff in numbering system, documentation system methods, record keeping, proper fiber terminations, and fiber jumper installations.

END OF SECTION

SECTION 270133

Shop Drawings Product Data Samples Design Records & Existing Conditions

PART 1 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1.1 SUBMITTALS

A. The Contractor:
   1. Shall not perform any portion of the work requiring submittal and review of shop drawings, product data, or samples until the Owner has approved the respective submittal. Such work shall be in accordance with approved submittals.
      a. Shop drawings as required by the owner, or as a minimum, to include a minimum of two sets of a plan view and elevations of all work to be installed. The Contractor shall make any corrections required by the owner or the owner's representative or consultant team, file with him two corrected copies, and furnish such other copies as needed. The consultant's approval of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless he has in writing and called to the Architect's attention such deviations at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings or schedules.

B. The Contractor shall provide a copy of the Certified Test Data Sheet, available from the delivering distribution warehouse, for either a full run or cut piece from the Master Reel of the fiber cable to be installed
   1. The Certified Test Data Sheet shall include the Master Reel number, cable description, passing test result with details, test equipment description, date certified, and a certificate of compliance stamp. It shall be included in the O&M Manual as a component of the final deliverables submittal package.

1.2 DRAWINGS

A. Shop Drawings
   1. The Contractor shall:
      a. Submit catalogue cut sheets that include manufacturer, trade name, and complete model number for each product specified. Model number shall be handwritten, marked with an arrow, or underlined to indicate exact selection.
      b. Identify the applicable specification section reference for each product performance for each component specified for approval before purchase and installation.

B. Record Drawings
   1. Drawings for the cabling system infrastructure elements shall be maintained and kept on file by the Siemon Certified Installer (Company) for the entire term of the warranty. Drawings shall include:
      a. Horizontal cable routing and terminations
      b. Telecommunications outlets/connectors
      c. Backbone cable routing and terminations
      d. Telecommunication Spaces (TS)

C. Samples
   1. For workstation outlet connectors, jack assemblies, housing, and faceplates for color selection and evaluation of technical specifications and requirements. Confirm the color with the architect, the interior designer, and the owner representative before purchasing materials. Face plates shall match the electrical face plates in Color and material type.

2. Upon request, provide samples for workstation outlets, jacks, and jack assemblies in the specified finish, one for each size and outlet configuration
3. Sample mock-up rooms may be required in some areas to ensure proper equipment placement and fit.

D. Qualifications:
1. The Contractor shall provide the appropriate documentation to comply with the requirements outlined in Section 014323 Qualifications, included with and at the time of the bid submission.

PART 2 - SUSTAINABLE DESIGN RECORDS AND REPORTS

2.1 DRAWINGS

A. Closeout Submittals (As-built Drawings):
1. Communications Design drawings will be supplied to the Architect so that the master “As-Built” drawings can be prepared.
2. As-built drawings shall be compatible with the Architect and consultant's format. The dimensions and scale of the drawing sheets submitted shall match the size of the drawing used for the contract documents and shall include the cable numbers labeled per this document.
3. Utilize commonly recognized drafting procedures that match standards, architect and consultant guidelines, and methodology.
4. The As-Built drawings shall incorporate all changes to the building identified in, but not limited to, addendum, change notices, site instructions, or deviations resulting from site conditions.

B. Contractor shall:
1. Clearly identify any resubmitted drawing sheets, documents, or cut sheets by using a color to highlight or cloud around resubmitted information.
2. Maintain consistency of drawing numbering or page/sheet scheme per previously issued drawings/documents.
3. Provide dimensioned plan and elevation views of networking components, showing:
   a. All communications data/voice outlet locations complete with outlet/cable labeling.
   b. Cable routing paths of communications cables to identified infrastructure pathways.
   c. All rack and cabinet locations and labeling thereof.
   d. One-line diagram of equipment/device interconnecting data/voice cabling of the data and voice systems.
   e. Standard or typical installation details unique to the Owner’s requirements.
   f. Graphic symbols and component identification on detail drawing shall conform to the latest ANSI/TIA 568-C, ANSI/TIA 569-B, ANSI/TIA 606-A, and ANSI/NECA/BICSI 607-A conventions.
4. Submit one soft (compatible with Microsoft software) and hard copy with project deliverables within three weeks after substantial completion.
5. A hard copy of the floor plans shall be plotted to a standard, saleable, identified drawing scale for record.

2.2 RECORDS AND REPORTS

A. All records shall be created by the installation contractor and turned over at the completion of work.
1. The format shall be computer-based
   a. Soft copies and hard copies shall be part of the As-built package.

b. The minimum requirements include:
   1) Cable records must contain the identifier, cable type, termination positions at both ends, splice information, and any damaged pairs/conductors.
   2) Connecting hardware and connecting hardware position records must contain the identifier, type, damaged position numbers, and references to the attached cable identifier.
c. The As-built package shall include Test documentation on all cable types.

B. All Siemon Warranty Registration documents shall be included.

C. All reports shall be generated from the computer-based program used to create the records above. These reports should include, but not be limited to:
   1. Cable Reports
   2. Cross-connect Reports
   3. Connecting Hardware Reports

PART 3 - EXISTING CONDITIONS SITE SURVEY

3.1 SITE SURVEY

A. Before placing any cable pathways or cable, the contractor shall survey the site to determine that job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager must be determined at that time.

END OF SECTION

SECTION 270143

Qualifications and Required Training for Contractors and Installers

PART 1 - GENERAL INSTALLER QUALIFICATIONS

1.1 ENTITIES

A. Communications contractors
   1. The Communications Contractor shall, at a minimum, possess the following qualifications:
   2. The contractor shall be a Siemon Certified Contractor with valid, up-to-date contract certification and good standing with the Siemon Company.
   3. Be in business for a minimum of five (5) years.
   4. The contractor shall demonstrate satisfaction of sound financial condition and be adequately bonded and insured if the project deems it necessary.
   5. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
   6. Use personnel knowledgeable in local, state, provincial, and national codes and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

B. Contractors must possess current liability and workers' compensation insurance certificates.

C. Contractors must be registered with BICSI and have at least one RCDD on staff or an ITS Cabling Installer Program Technician certification and Installer Level 1 & 2 for a minimum of 75 percent of staff.

1.2 TRAINING

A. The Contractor shall be fully conversant and capable of cabling low voltage applications such as, but not limited to, data, voice, and imaging network systems. The Contractor shall, at a minimum, possess the following qualifications:
   1. Personnel trained and certified in the design of the Siemon Cabling System®.
   2. Personnel trained and certified to install the Siemon Cabling System®.
   3. The Designer and Installer shall show proof of the Siemon Cabling System®'s current certification via an updated certificate given after attending the Certified Installer training course or an online recertification class given every two years.
   4. Provide references for the type of installation provided in this specification.
   5. Personnel trained and certified in installing copper cable and using Level IIIe Copper Transmission Performance testers, fiber optic cabling, splicing, termination, and testing techniques. Personnel must have experience using an optical light source, a power meter, and an OTDR.
   6. Personnel trained in installing pathways and supports for housing horizontal and backbone cabling.

B. Facilities Orientation
   1. Personnel must complete the on-site Facilities Orientation

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 270171
Responsibility and Workmanship of Contractor

PART 1 - GENERAL

1.1 CONTRACTOR RESPONSIBILITY

A. The contractor shall be obligated to exercise the highest standard of care in performing its obligations as defined in a request for proposal. All work shall be done in a workmanlike fashion that meets the highest standards in the telecommunications industry.

B. All equipment and materials are to be installed neatly and securely, while cables are to be dressed appropriately in accordance with standards recommendations for a specific type of media (i.e., UTP vs. F/UTP @ 10 Gigabit)

C. Workers must clean any debris and trash at the close of each job and workday.

D. The Contractor acknowledges that Intermountain Health will rely on the Contractor's expertise, ability, and knowledge of the proposed system and shall be obligated to exercise the highest standard of care when performing contractual obligations as defined in the Scope of Work.

E. The contractor must submit the Siemon warranty, cable records, as-built drawings, and test results upon completion of the work. Note: Intermountain Health reserves the right to withhold final payments until all registration documents are approved by the Siemon Company and received by Intermountain Health.

1.2 CONTRACTOR AND EMPLOYEE RESPONSIBILITY

A. Contractors, their employees, and installers will attend Intermountain Health's required Infection Control training annually.

B. Contractors, their employees, and installers will complete Symplr registration.

C. Contractors, their employees, and installers will attend Intermountain Health's required site and job-specific orientation.

D. Contractors, their employees, and installers will maintain Intermountain Health's required immunizations.

E. Contractors, their employees, and installers will keep their Intermountain Health required confidentiality agreements current.

F. Contractors, their employees, and installers always agree to follow all Intermountain Health Policies and procedures and wear the appropriate ID while on any Intermountain properties.

G. The contractor will determine with the Owner the appropriate level of Environmental Containment precautions to utilize for each work location. Infection Control Risk Assessments and permits will be performed as required.

H. Upon request, provide qualification data for all qualified layout technicians, installation supervisors, and field inspectors.
   1. Siemon issued qualification badges shall be readily available for this purpose.

1.3 EXAMINATION

A. Field Measurements: Before fabrication, verify dimensions in installation areas by field measurements and indicate measurements on shop drawings. Coordinate the fabrication schedule with construction progress to avoid delaying the work.

B. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

1.4 PREPARATION

A. Pre-installation inspection
   1. The Contractor shall visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are unacceptable and shall be replaced by the contractor at no additional cost to the Owner.

1.5 MISCELLANEOUS CONTRACTOR RESPONSIBILITIES

A. Contractors will maintain unobstructed egress in work areas.

B. The contractor will keep access to all emergency services.

C. Contractor will maintain training for Personnel in alternate exits if needed.

D. Contractor will maintain Temporary construction partitions, as required, that are smoke-tight and built of non-combustible materials.

E. Additional Fire Extinguishers may be required and will be adequately maintained and inspected.

F. The construction site will be maintained clean and orderly.

G. The contractor will observe Intermountain Health’s Tobacco Use Policy. (All forms of tobacco use are strictly prohibited.)

H. All Electrical Extension cords will be grounded, in good condition, and plugged into approved GFI Receptacles.

I. Construction sites will be restricted. (Approved personnel only)

J. Personal Protective Equipment (PPE) will be worn as required. (i.e., hard hats, safety glasses, safety shoes, fluorescent vest, in accordance with the general contractor's safety policy)

K. Tools will be unplugged, and power will be secured at the end of each working day.

L. All employees and contractors will understand how to obtain MSDS sheets.

M. The contractor will notify the proper personnel of any fire system shutdown within 48 hours.

N. The contractor will address all vibration concerns to Intermountain Health and the general contractor's staff.

O. The contractor will address all Noise Issues with Intermountain Health and the general contractor's staff.

P. The contractor will fill out a Hot Work permit and keep it on site daily as needed.

Q. The contractor will fill out an Above Ceiling Work Permit and keep it on site daily as needed.

R. The contractor will complete an Infection Prevention permit and not begin work until approved.

S. Contractors will obtain a Confined Space Permit, when required, and keep it on site.

T. The contractor shall notify Information Systems 72 hours before any shutdown or known interruption of required environmental services. Follow up by notifying the Service Desk.

U. The low-voltage installation contractor shall perform demolition of low-voltage cabling.
   1. To prevent accidental removal of in-use circuits.
   2. To allow for the re-use of circuits where practical.

V. Before removing unused low-voltage cabling, you must verify that both ends are no longer attached to any device. (Both ends of the cable are un-terminated).

END OF SECTION

SECTION 270500
Common Work Results for Communications

PART 1 - PRODUCT

1.1 SUMMARY

A. This section covers general work results for all Communications Division detail subsections.

B. Work of the following sections covers a complete installation of permanent and channel links for a data and voice communications network utilizing copper and fiber transmission media.

PART 2 - EXECUTION

2.1 SCOPE OF WORK

A. Includes, but is not limited to, the following.
   1. The Contractor shall:
   2. Provide and install fabric and/or plenum, PE, or PVC Innerduct, rated appropriately for the installation environment, in accordance with all applicable codes and ordinances.
   3. Provide, install, terminate, test, label, and document all fiber backbone, fiber, and copper riser cable.
   4. Provide, install, terminate, test, and document all fiber, copper voice, and data horizontal cable.
      a. CAT6A UTP and CAT6A F/UTP shall not be mixed on the same campus.
   5. Provide and place all termination devices, such as, but not limited to, modular patch panels, blank panels, termination blocks, information outlets (jacks and plates), phone jacks, fiber distribution panels, bulkheads, connectors, and fiber fan-out kits.
   6. Provide in quantities specified interconnect components such as, but not limited to, copper patch cords, fiber patch cables.
   7. Provide and place horizontal and vertical cable support devices such as, but not limited to, rack and wall-mounted horizontal and vertical cable management, cable runway, communications cable runway, and all required mounting hardware, unless otherwise noted.
   8. Provide and install all equipment, mounting racks, cabinets, and/or brackets.
   9. In coordination with the general contractor, provide and install UL-approved fire-stopping systems in all communication pass-thrus, conduits, cable trays, and ceiling, wall, and floor penetrations.
   10. Provide all appropriate consumable items required to complete the installation.
   11. Grounding and bonding in TEC and TR rooms to grounding bus provided by Division 26.
   12. Provide complete documentation and demonstration of work.
   13. Completion of all punch list deficiencies within 10 working days.
   14. Provide indexed and organized complete Test Results of all copper and fiber cable and their components.
   15. Provide Submittals.
   16. Conduct a final document handover meeting with the client, consultant, and PM to review, discuss, and educate the Owner on the test results and As-Built Drawings.
   17. Provide a Manufacturer’s Extended Product Warranty and System Assurance Warranty for this wiring system.

END OF SECTION

SECTION 270526
Grounding and Bonding for Communications Systems

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This work shall be provided by Division 26.
   1. Division 26 shall provide and install the communications system grounding bus bar.

B. Systems other than the voice/data system shall be bonded by their respective installers or Division 26.

C. Exception: Division 27 shall bond racks, ladders, and other conductive IT equipment and enclosures as required.

D. Requirements of the following Division 26 Sections apply to this section:
   1. Basic Electrical Requirements
   2. Basic Electrical Materials and Methods
   3. Grounding and Bonding for Electrical Systems

1.2 SUMMARY

A. This Section includes methods and materials for grounding and bonding Communications systems.

B. All grounding/earthing and bonding shall comply with applicable codes and regulations. It is recommended that the requirements of IEC/TR 61000-5-2: 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
   1. Stranded conductors No. 6 AWG.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Compression fitting – 2-hole strap.

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 (NEC), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

3.2 APPLICATIONS

A. Conductors: Install stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

3.3 INSTALLATION

A. Grounding Conductors
   1. Route along the shortest and straightest paths, unless otherwise indicated or required by Code.
      a. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
         1) The jumper across all tray junctions uses two-hole crimp lugs with a bolt, lock washer, and nut to prevent the ground connections from loosening over time.
         2) The contractor will remove a small powder coat or paint area to create a metal-to-metal bonding connection.
         3) Per current BICSI TDMM "Grounding, Bonding and Electrical Protection":
         4) Grounding and bonding connectors should be one of the following: Tin-plated copper, copper, or copper alloy
         5) Connections should be made using crimp connectors or exothermic welding.
         6) Per TIA/EIA 607-A the TBB (Telecommunications Bonding Backbone) connections "shall be made using irreversible compression-type connectors, exothermic welding or equivalent."

END OF SECTION

SECTION 270528
Pathways for Communications Systems

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Main pathways for communications systems shall be the responsibility of the Division 27 low-voltage contract.
   1. Includes, but is not limited to, hangars, supports, J-hooks, and cable trays.
   2. Sections 270536 and 270543_46 are supplemental clarifications that are additions to this section. The appropriate section(s) shall be added for the material used.

B. The Division 26 electrical contractor shall be responsible for conduits, pathways, and boxes embedded within building finishes for communications systems.

C. Requirements of the following Division 26 sections apply to this section.
   1. Basic electrical requirements
   2. Basic electrical materials and methods
   3. Grounding, earthing, and bonding for electrical systems.

1.2 SUMMARY

A. Contractors shall install work following specifications, drawings, manufacturer’s instructions, and approved submittal data.

PART 2 - PRODUCTS

2.1 CABLE PATHWAYS

A. Comply with TIA/EIA-569-B.

B. Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations.
   1. All materials shall be UL-and/or CSA- and/or ETL-approved and labeled in accordance with NEC for all products where labeling service typically applies.
   2. NRTL is labeled for support of Category 6A cabling and designed to prevent degradation of cable performance and pinch points that could damage the cable.
   3. Materials and equipment requiring UL 94, 149, or 1863 listing shall be so labeled. Modification of products that nullify UL labels is not permitted.
   4. The installed systems shall not generate or be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades or obstructs any equipment.

C. Pathways consist of fire-rated sleeves, conduit, basket tray/ladder rack, J-hooks, surface-mounted raceway, and power poles.
   1. Basket trays shall be utilized for distribution pathways.
      a. Provides proper support and load distribution along pathways.
      b. All wall penetration for the basket tray shall be framed.
      c. Flexibility, scalability, and accessibility.
      d. The ladder rack shall be used for all TEC and TDRs.
   2. Conduits may be utilized where basket trays are not viable, provided the conduit's cross-sectional area is greater than the basket tray's.

3. Fire-rated sleeves must be used instead of conduit when penetrating a fire-rated wall.
   a. 2” x 2” for room penetrations, 4” x4” for j-hook pathways
   b. Approved Manufacturers
      1) STI EZ Path
      2) Hilti Modular Sleeve
4. J-hooks are the minimum pathway device required for all low-voltage contractors for use in ceiling distribution.
   a. Refer to section 270529.
      Note: Surface-mounted raceway and power poles should be installed only when other pathway choices are not feasible.

D. Outdoor Microduct
   1. Manufacturers
      a. Duraline
      b. Pre-Approved Equal
   2. Description: 7 Way MicroDuct
      a. All Microduct shall comprise all dielectric materials (except for the armored version). All Microduct shall be manufactured to include enhanced jetting design, such as internal ribbing to minimize surface contact and a permanent slick interior to eliminate the need for jetting lubricant.
      b. 12.7mm OD1MM ID
      c. Microduct rating FP (OSP)
      d. 7-Way
      e. Color: Orange

2.2 EQUIPMENT

A. Compatibility
   1. All material and equipment provided should be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacture of such products. They shall all be typical commercial designs that comply with the requirements specified. All material and equipment shall be readily available through manufacturers and/or distributors.
      a. All equipment shall be standard catalogued items of the manufacturer and shall be entirely supplied with any optional items required for proper installation.
      b. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance and backward compatibility

B. Horizontal cables shall be installed in “clean, dry” locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables.
   1. Cable pathways shall be installed to provide protection from the elements (i.e., moisture) and other hazards.
   2. Cables and cable pathways shall be protected from detritus elements such as paints, adhesives, water, and cleaners.
      a. In case of contamination, the cables shall be replaced at the expense of the General Contractors. Cleaning is not acceptable.
         1) Pathways shall not have exposed sharp edges that may meet telecommunications cables.

C. Pathways shall not be in elevator shafts.

D. Grounding / Earthing and bonding of pathways shall comply with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2—Ed. 1.0, ANSI-J-STD-607-B, or both, be observed throughout the entire cabling system.

2.3 SURFACE MOUNTING

A. Surface Mount Cable Runs and Faceplate Boxes
   1. Surface mounting of cable pathway runs and/or boxes for outlets/faceplates is only authorized as a last resort and as an exception to running cables through the wall and above the ceiling.
      a. If surface mount cable runs are used:
         1) Burs will be removed from the inside of the plastic or metal surface mount pathway to prevent damage to cables pulled through the run.
         2) Raceway manufacturer plastic bushings shall be installed at all outlet openings in the raceway to prevent damage to the cable.
         3) “T”, Splice, and corner pieces will be used to join runs. Runs will not be butted together without the appropriate joining pieces.

PART 3 - EXECUTION

3.1 HORIZONTAL PARAMETERS

A. Allowable Cable Bend Radius and Pull Tension:
   1. In general, communications cables cannot tolerate sharp bends or excessive pull tension during installation.
      a. The bend radius for four pair UTP and F/UTP under no load (no pulling tension) shall not exceed four (4) times the outside diameter of the cable and eight (8) times the outside diameter of the cable under load (110N/25lbf). Note: Cable bend radius and pulling tensions for cables other than 4-pair cables increase with the diameter and type of cable. Refer to the manufacturer’s recommendations for specific requirements.
   2. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue. Use only lubricants designed explicitly for cable installation.

B. Pull Strings:
   1. Horizontal and Vertical Pathways
   2. The pathway installer shall:
      a. Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract.
      b. Provide pull strings in all new cable trays.
      c. The pull string shall have a rated average breaking strength of 200 pounds.
      d. Pull strings must move freely during pulling sessions to prevent cable jacket/cable damage.
      e. Free-moving pull strings shall be provided in all locations where they are utilized as part of this contract.
   3. Conduit Fill:
      a. Reference the manufacturer's Design Installation Guidelines manual.
      b. Comply with the requirements of NFPA 70 (NEC)
      c. c. The number of cables placed in a pathway shall not exceed the manufacturer's specifications, and the geometric shape of a cable will not be affected.
         1) Conduit pathways shall have a maximum fill ratio of 40% to allow for proper pulling tension and the laying of the CAT6A F/UTP cable. A minimum of a 1” diameter conduit is required for new construction. Existing conduits will require reducing the number of cables placed in the conduit to meet the required fill ratio.

3.2 INTRA-BUILDING CABLE ROUTING

A. Pathways

1. The backbone subsystem shall include cable installed vertically between floor telecommunications rooms and the main or intermediate cross-connect in a multi-story building, and cable installed horizontally between Telecommunications rooms and the main or intermediate cross-connect in a long single-story building.
2. Adequate riser sleeve/slot space shall be available in all telecommunications rooms, with the ability to ingress the area later, so no drilling of additional sleeves/slots is necessary. All sleeves/slots are required for proper fire stopping per national and local codes. Install fire stop material designed specifically for the building construction conditions and to meet the existing fire stop material as directed by the building engineer.
3. Backbone pathways shall be installed or selected so that the minimum bend radius of backbone cables remains within the manufacturer's specifications during and after installation.
4. Where redundant paths are required, they shall be separated by a minimum of 24”.
   a. Separate innerducts and/or armored fiber are required for each leg of the redundant path.
   b. Separate physical routes for each path shall be utilized where possible.
5. Building backbone cables shall be installed in “dry” locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables.
6. “Slab-on-Grade” building designs wherein pathways are installed underground on/in the poured concrete slabs in direct contact with the soil are considered wet locations and hence are not permitted.

END OF SECTION

SECTION 270529
Hangers and Supports for Communications Systems

PART 1 - PRODUCTS

1.1 APPROVED PRODUCT

A. The J-hooks shall meet or exceed the characteristics of construction and features below
   1. Provide broad-based support for cabling to aid in maintaining overall system performance.
   2. Be available in 50.8mm (2”) and 101.6mm (4”) options
   3. Come equipped with a cable retention clip
   4. Offers a full line of mounting accessories.

1.2 APPROVED MANUFACTURERS

A. Ericson / Caddy

B. B-Line

C. Stiffy

PART 2 - EXECUTION

2.1 J-HOOKS AND OTHER SUPPORTS SHALL BE INSTALLED SUCH THAT

A. They are supported by devices designed for this purpose and shall be installed independently of any other structural component. J-Hooks shall not use the suspended ceiling support wires or lighting fixture support wires.

B. The number of cables placed into the J-hooks shall be limited to a number that will not cause a change to the geometric shape of the cables.
   1. Limit to a 40% fill in new construction.

C. J-hooks shall not be spaced farther than 1.5 meters (5 ft.) apart, with a recommendation that they be spaced at 1 meter (3 ft.) apart. Note: Construction may require distances to exceed the maximum and are considered an exception requiring approval of the project manager or building engineer.

D. J-hooks or better must be installed without exception.

E. All J-hooks that pass through a fire-rated wall must have an EZ-Path Sleeve or Hilti Modular Sleeve installed to go through the fire wall. The size is to be based on the size of the J-hook. To be installed by the Low Voltage Contractor installing the J-hooks.

2.2 UNACCEPTABLE INSTALLATIONS

A. Free flight of cables

B. Resting or attaching cables on pipes, conduits, HVAC duct work, fire sprinkler systems, basket tray, basket tray supports, or ceiling tiles/grid.

END OF SECTION

SECTION 270533
Conduits and Back Boxes for Communications Systems

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division 26-Electrical work

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

A. Conduits and back boxes shall meet the construction requirements of the NEC for the type of structure and space in which they are installed. They will be of the diameter and size required to provide adequate fill, bend radius, and connector space. Refer to section 270528

PART 3 - EXECUTION

3.1 CONDUIT SIZING

A. Conduit size shall be based on the type of cable installed and the required fill ratio and bend radius associated with the specified kind of cable.
   1. The minimum conduit size for the back box for CAT6A F/UTP shall be a 1-inch EMT.

Conduit Trade Size (metric designator)	Max number of cables based upon allowable fill		
	Cable O.D.		
	7.4mm (0.29 in.)	8.4mm (0.33 in.)	8.9mm (0.35 in.)
1 (27)	4	3	2
1-1/4 (35)	6	5	4
1-1/2 (41)	9	7	6
2 (53)	14	11	10
2-1/2 (63)	20	16	14
3 (78)	31	24	22
3-1/2 (91)	42	32	29
4 (100)	54	42	37

B. Conduit and installation shall be provided by Division 26.

C. All conduit stubs shall be installed with plastic bushings appropriate for the size of conduit used.

D. Conduits that stub to the accessible ceiling shall be installed in the direction that provides the shortest path to the TDR, complete with a pull string.

E. Conduit pathway must be provided to the nearest basket tray when the area has a hard lid or a decorative ceiling.

3.2 BACK BOX SIZING

A. New work back boxes for CAT6A F/UTP shall be a minimum of trade size 4-11/16” x 4-11/16” x 3” (depth) plus a 5/8” plaster ring to allow for proper bend radius and connector termination/installation. Side knockouts shall be avoided.

B. Back boxes for rework shall meet the exact specifications as those for new work.
   1. If existing back boxes or back boxes are smaller due to construction restrictions, devices such as extension rings, bezels, or faceplates shall be used to modify the back box to ensure proper bend radius and connector termination/installation.
      a. Verification and approval of the size change must be obtained from DCO Infrastructure Cabling and engineering.

3.3 BACK BOX COMPOSITION

A. All back boxes for IT systems shall be UL/CSA listed and approved for the purpose.
   1. Non-metal back boxes shall not be used for any interior IT-related device.

3.4 SPECIAL CONDITIONS – LEAD LINED WALLS FOR RADIATION CONTROL

A. Refer to the complete IT Lead Lined Wall Procedure – Attachment Appendix 8

END OF SECTION

SECTION 270536
Cable Tray for Communications Systems

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This section shall be coordinated with Sections 270528, and 270543_46

1.2 COORDINATION

A. Before beginning installation, a kick-off meeting should be held to coordinate the tray installation and expectations properly. The General Contractor should arrange it and, at a minimum, include representatives of the following trades: FP&D, Electrical (Div 26), Structured cable, Nurse Call, paging, building automation and control, plumbing, HVAC, fire sprinkler, framing, and others as applicable.

B. The low-voltage CI cable contractor (Div. 27 subcontractor) and the Data Center Operation Team shall approve and install the wire basket tray routing.

C. Where adequate space is available, a 4”, triple-tier J-Hook pathway shall parallel the basket trays for other services

D. The cable tray installer shall install the triple-tier J-Hooks.

E. Single J-Hooks, as needed to extend beyond the triple tier, shall be installed by the trade that will utilize them.

F. The cable tray shall be a high-priority installation to allow adequate time for proper and complete cable installation before the ceiling grid.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

A. The Cable Ladder Tray meets or exceeds the characteristics of construction and features below:
   1. It shall be fully welded and available in a galvanized silver or powder-coated black finish
   2. Have an optional construction using “elongated” shaped wires offering broader support for installed cables.
   3. The Cable ladder tray shall be used in data rooms for horizontal management above the racks.
   4. Ladder shall match the manufacturer of the data racks or be an exact equal.
   5. The ladder shall be assembled with manufacturer-approved parts and methods.
   6. Ladder Rack must be installed using waterfalls.

2.2 PART NUMBERS (SUBMITTAL REQUIRED)

A. Cable Ladder Tray
   1. Refer to Appendix 3 or the plans for part numbers.

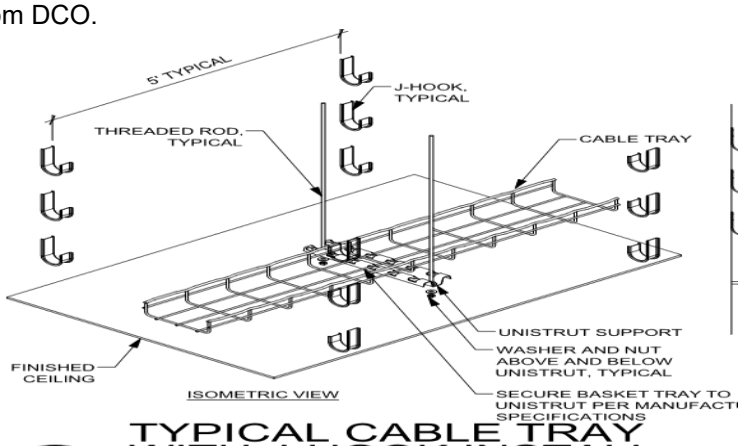
B. APPROVED BASKET TRAY MANUFACTURERS
   1. WBT – Wire Basket Ray (preferred).
   2. Siemon RouteIT TM Wire Mesh Cable Tray, or equal basket-type tray.
   3. Cabolfil per owner’s approval.

PART 3 - EXECUTION

3.1 PATHWAY INSTALLATION

A. Supports
   1. Installed per the Manufacturer's Specifications and utilize components specific to the maintenance of proper access in and out of the basket tray using bend delimiters.
   2. Distance between supports shall not exceed 5 feet
      a. Less distance between supports required if per the manufacturer's instructions.
      b. A minimum of one support is required within 24" on each side of any junction point.
   3. Supports shall be of the trapeze design to provide maximum stability.
      a. Each support shall attach to the structure via its own hangers.
         1) All hanger supports shall be constructed of rigid material such as all-thread.
         2) All hangers and supports shall be installed perpendicular and plumb to the tray. No angle supports shall be permitted unless augmented perpendicularly.
         3) Vibration and sway (seismic) damping is required.
         4) Provide support across the tray width underneath, not via the basket side wires.
         5) Building walls do not qualify as support and shall not be used as support.
         6) All basket tray penetrations through a wall are to be framed by the General Contractor.
      b. Support shall be of sufficient strength to support at least 200% of the expected load
   4. Wall-mounted angle brackets shall not be used as a load-bearing support for the basket tray.
   5. Basket Tray should not be installed directly below pressurized water pipes.

B. Complete system access
   1. Basket trays shall have a dedicated free clearance zone surrounding them.
      a. 12" clear space shall be provided on the side where natural feed will occur.
      b. 6" clear space shall be provided on the side opposite the feed access.
      c. 8" clear space above the top of the tray, minimum – recommended 12".
      d. 3" clear space below the tray.
   2. Exception: Other services may pass through the free clearance zone provided it is perpendicular to the tray direction and does not exceed 6' in width or interfere with the access to pull wire in the tray.
   3. When the basket tray is installed in Hard Lid or decorative locations, access panel locations must be installed at corners or T intersections. Consult DCO personnel on placement.
   4. NOTHING shall be attached to the basket tray or basket tray supports without prior written approval from DCO.



TYPICAL CABLE TRAY WITH J-HOOK INSTALL
#
NO SCALE

3.2 ROUTING OF BASKET TRAY

A. The exact basket tray location shall be coordinated with other trades to ensure proper clearances and access. Prior to installation, the owner's DCO/infrastructure cabling team must approve the final cable tray routes.

B. Basket tray shall be installed in straight lines, either parallel or perpendicular to building lines

C. Wire basket trays are assumed to include joiner kits, stabilizer kits, rack mount kits, splices, clamps, hangers, supports, waterfalls, and thus no accessories are called out below except the tray divider.

D. Cut basket tray structural components/rods will not be left with any edges that can cause injury to the skin and eyes by someone in the ceiling working. Cut ends are to be covered with a coating or cap.

E. A waterfall device will protect all changes in cable elevation(s) transitioning between the basket tray and the cable rack.
   1. This may also be mitigated by creating a rack ‘ramp’ which lowers the upper rack to the lower rack by cutting and bending the upper rack to slope downward to the lower rack.
   2. This method requires DCO pre-approval and proper ceiling support for the ramp.

F. Basket tray shall follow the corridor paths
   1. Routing above rooms and other partitions shall be avoided
   2. The cable tray shall not block access to VAV’s valves or other similar equipment.

G. Basket tray and flush penetrations shall be utilized over hard-lid areas as specified.

H. Access panels shall be provided where needed to access the basket tray on both sides of the wall in hard lid areas within 3’ or less of the basket tray.

3.3 TRAY INTEGRITY

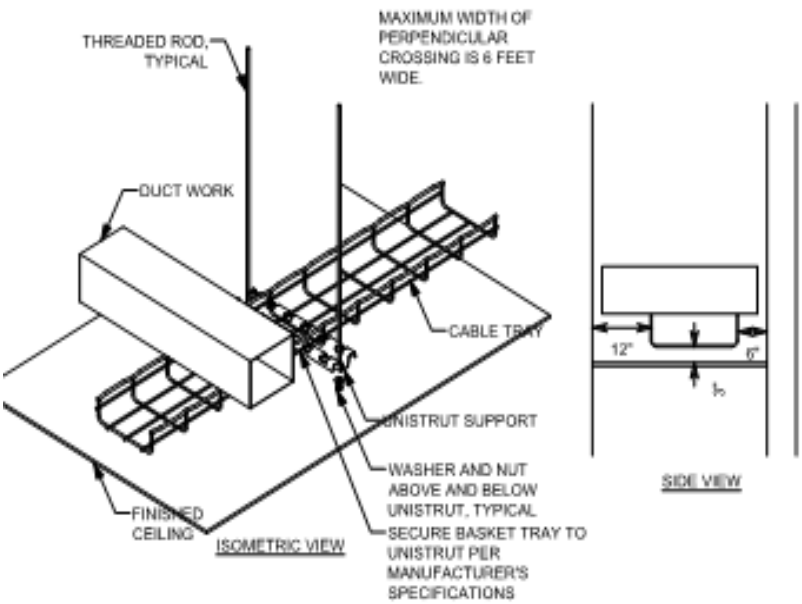
A. The tray shall be installed as a complete, continuous system with no open spaces, cutouts, or missing segments. Bonding between sections shall be accomplished by the manufacturer’s approved clamp or designated method.

B. Trays shall be free from obstructions, other systems, trash, or debris. Access to the tray shall be provided as outlined.

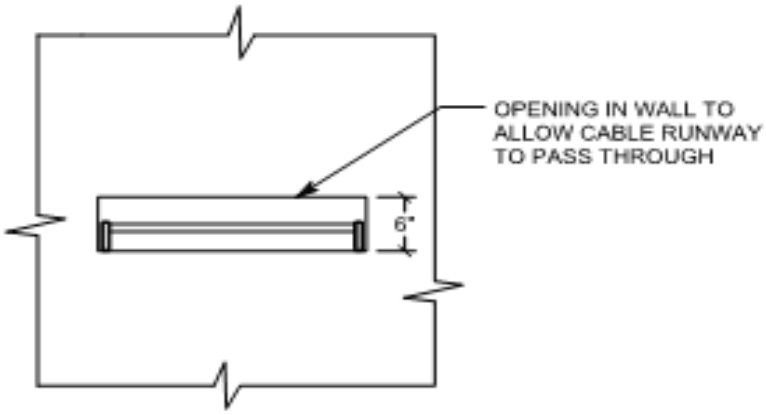
C. No other trade infrastructure or equipment may be connected to or rely on the basket tray or its support system.

D. Tray must not be notched or cut out to accommodate other trades. Repairs will not be accepted. Section replacement will be required at no cost to the owner.

E. As much tray material as possible shall be left uncut at turns, junctions, elevation changes, width changes, etc. Overlap shall be clamped to maximize strength and prevent pinch points.



TYPICAL CABLE TRAY WITH PERPENDICULAR CROSSING



CABLE RUNWAY THROUGH WALL DETAIL

3.4 WALL OR OTHER PENETRATIONS (SUBMITTAL REQUIRED)

A. Fire and smoke-rated assemblies

1. Penetrations shall comply with all fire and smoke prevention methods per code and as outlined in this document, including Section 270528 and Division 7 (Thermal and Moisture Protection).

B. Approved penetration methods
1. The preferred barrier penetration method shall be to run the tray continuously through the barrier, with closure provided by Firestop pillows.
   a. Framing shall be boxed around openings to permit proper pillow insertion. Coordinate with the framing contractor.
2. Sleeves or conduits
   a. Fire assemblies or alternate penetrations must provide 150% of the designed cross-sectional area of the basket.
   b. Conduit permitted only with written pre-bid permission or engineering notation on the drawings.
   c. c. Each penetration sleeve or conduit shall be bonded on both sides of the penetrated barrier using UL and AHJ-approved methods.
3. All penetrations shall be positioned in line with the basket tray to facilitate ease of pulling conductors and provide a straight-line path.
   a. The bottom of the penetration device shall be flush with the bottom of the basket tray
   b. Side-to-side penetrations must be entirely within the cable tray space or directly above whenever possible.
4. Approved penetration devices shall be a minimum size of 4”
   a. The total penetration space at each location shall be sized for 20% growth and equal to or greater than the cross-sectional area of the basket tray.
5. Approved devices where smaller penetrations are permitted shall be a minimum size of 1”.
6. The local facility manager shall approve devices:
   a. Fire-rated assemblies
   b. Tray with enclosed walls, properly sized and installed pillows
   c. Conduit sleeves
      1) Conduit sleeves should only be used as a last resort upon approval from the owner’s DCO representative.

3.5 UTILIZATION

A. Capacity
1. Trays and penetration devices shall be sized appropriately
   a. Provide a maximum calculated fill ratio of 40% to an inside depth not to exceed 3 inches (75 mm)
   b. Provide capacity to allow for at least 20% future growth

B. Systems served
1. A single system shall be dedicated to Basket trays, J-hooks, and penetrations. Mixing of other systems with voice and data shall not be permitted in tray or J-hook paths.

C. Restricted content in trays
1. The wire basket tray shall only contain voice and data communications system cables.
   a. If there is sufficient space in the tray, and with approval from both the data network subcontractor and DCO, certain other IP services (e.g., camera, telemetry, etc.) may share tray space.
   b. Service loops must not reduce tray capacity.
   c. Nurse call cabling shall be run in the J-Hook path. All nurse call installations must provide their own path or utilize the triple J-Hook system.

D. Triple J-Hook
1. Triple Tree J-Hooks – Caddy CAT64HPS WM3

2. Path Assignments
   a. The Lower tier of the triple J-Hook path is designated for Card Access, building automation, and controls
   b. The Middle tier of the triple J-Hook path is designated for Nurse Call.
   c. The Top tier of the triple J-Hook path is designated for satellite, DAS, or similar systems.
3. When a triple J-hook pathway is not installed or available, each system provider shall install its own J-hook pathway and wall penetrations.
4. Service loop and slack shall not interfere with other pathways.
5. Triple J-Hooks must be a minimum of 4 hooks each.

END OF SECTION

SECTION 270543-46

Underground Ducts, Utility Poles, and Raceways for Interbuilding/Campus Cable Routing

PART 1 - PRODUCTS

1.1 INTER-BUILDING/CAMPUS CABLE ROUTING

A. The backbone subsystem shall include cable installed between buildings via approved underground, tunnel, direct-buried, aerial, or any combination of these from the Campus Distributor/Main Cross-connect (CD/MC/TEC) to the Building Distributor/Intermediate Cross-connect (BD/IC/TDR) in a multi-building campus.
   1. 4” Conduit is required
   2. (3) 1 ¼” inner ducts shall be installed in (1 out of 2 or 2 out of 4) 4” conduits going from building to building.
   3. (2) 12.7/10 microduct and (1) 1 1/4” inner ducts shall be installed in (1 out of 2 or 2 out of 4) 4” conduits going from building to building.
   4. Armored Fiber is required.
   5. Microduct/microfiber is optional.
   6. All outdoor conduits must be capped.

B. Backbone pathways shall be installed or selected such that the minimum bend radius and pulling tension of backbone cables are kept within cable manufacturer specifications, both during and after installation.

C. In an underground system, adequate underground conduit space shall be available and accessible at each building. The conduits shall not exceed a fill ratio of 40%.
   1. All underground systems shall be designed to prevent water runoff from entering the building. They must be cleared of moisture before installing any cable type. These systems must be sealed at both ends when not in use and after cable installation to prevent moisture and rodent infiltration.

PART 2 - EXECUTION

2.1 INSTALLATION

A. The backbone cables shall be installed in a hierarchical star topology, emanating from the Campus Distributor/Main Cross-connect to each satellite building, Building Distributor/Intermediate Cross-connect, or Floor Distributor/Horizontal Cross-connect located in a telecommunication room. All inter-building/campus cables shall be installed according to the applicable codes and regulations.

B. Where redundant paths are required, they shall be separated by a minimum of 24”.
   1. Separate innerducts are required for each leg of the redundant path.
   2. Separate physical routes for each path shall be utilized where possible.

C. Optical fiber shall be run for all Inter-building/Campus backbone segments, and as a recommendation, at least one balanced twisted-pair cable should be run for each Inter-building backbone segment.
   1. Fibers will be fusion-spliced in the telecommunications rooms using LC Pigtails in wall-mounted interconnect centers or rack-mounted panels equipped with enough ports, slack storage space, and splice trays, if required, to terminate and secure all fibers.

D. ST connectors are no longer recommended in the TIA 568-C.3 standard but may be used in legacy installations.

E. Over-voltage Circuit Protection shall be utilized for cabling that enters or exits a building, and shall comply with applicable codes and regulations.

F. Per national and local codes and regulations, OSP (outside plant) cables shall transition to an ISP (inside plant) within 50 feet of the changing environment.

END OF SECTION

SECTION 270553
Identification for Low-Voltage Cables and Labeling

PART 1 - GENERAL

1.1 NOT USED

PART 2 - PRODUCTS

2.1 LABELING

A. Structured cabling shall be labeled in accordance with ANSI/TIA 606-B standards.

B. A unique identifier shall be marked on each faceplate to identify it as connecting hardware.

C. Each port in the faceplate shall be labeled with its identifier.

D. A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.

E. Each port on the connecting hardware shall be labeled with its identifier.

F. Cable Labeling
1. Label System
   a. Label Identification (Labeling) System:
      1) Brady
      2) Dymo
      3) Hellerman-Tyton
      4) Panduit
      5) Acceptable alternate
         a) Approval from the Data Center Operations Infrastructure Cabling team member is required before bidding.
2. Cable Labels
   a. Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations. Plastic, self-adhesive labels are not acceptable.
   b. Each end of the Horizontal cables shall be labeled with a mechanically generated label within 300mm (12 in) of the end of the cable jacket, with the link identifier, which shall be a unique configuration determined by the owner. This also applies to Backbone Cables.
3. Flat-surface labels
   a. Self-adhesive vinyl or vinyl-cloth labels, machine printed with alphanumeric cable designations.
4. Contractor shall:
   a. Provide transparent plastic label holders and four pairs of marked colored labels.
   b. Install colored labels according to the field type as per ANSI/TIA 606-B.1 color code designations.

G. Palette
1. Use the owner's color-code guidelines for voice, data, cross-connect, riser, and backbone fields. Otherwise, use the ANSI/TIA 606-B designation strip color-code guidelines for voice, data, cross-connect, riser, and backbone fields. Color designations for F/UTP cable:
   a. Intermountain Health Standard Wiring Palettes for Horizontal Cabling

Use	Color
Data & IP Phones	Blue
Analog Phone	Blue
Security Card Readers	Grey/Yellow
IP Security Cameras	Blue
Fire Systems	Red
TV Coax	Black
Public Address/Telecom Patching in TEC Only	White
Clinical Engineering a. Monitoring, Bed Systems b. Nurse Call (5e) c. Real time patient data	Orange Orange Orange Orange
Wireless	Yellow
Foreseer (Belden 1422)	Red

H. Outlet/Jack/Faceplate Icons/labeling will match the color of the cable attached to the back side of the outlet/jack.

PART 3 - EXECUTION

3.1 GENERAL IDENTIFICATION

A. The installer shall label all cables, regardless of length.

B. Identify system components, wiring, and cabling complying with TIA/EIA-606-B.1.Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

D. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use a unique, alphanumeric designation for each cable and label the cable, jacks, connectors, and terminals to which it connects with the same designation. At completion, cable and asset management software shall reflect as-built conditions.

E. Cable Schedule: Post in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with a rigid frame and clear plastic cover. Furnish an electronic copy of the comprehensive final schedules for the Project.

F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify the labeling convention and show labels for telecommunications rooms, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow the convention of TIA/EIA-606-B.1. Furnish an electronic record of all drawings in the software and format selected by the Owner.

3.2 CONCEALED ENDS

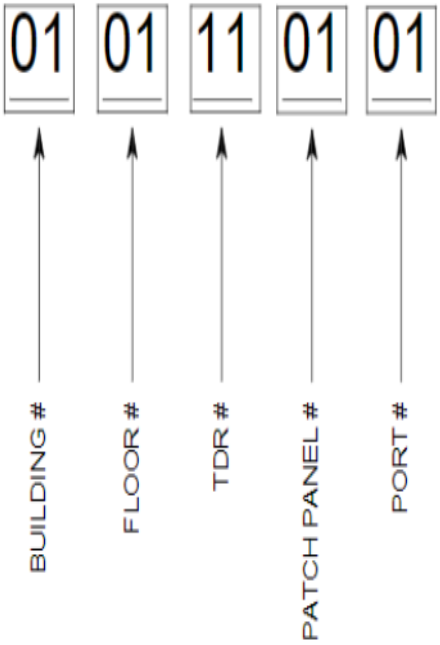
A. Jacks, connectors, terminations, and similar items concealed in locations such as above grid ceilings shall have additional labeling. The additional label shall be on the face of the grid in a visible location immediately adjacent to the termination location.

3.3 CABLE AND WIRE IDENTIFICATION

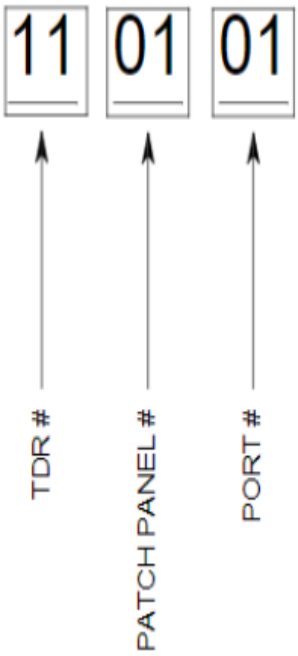
A. Label each cable visibly within 4 inches of each termination and tap, where it is accessible in a cabinet, junction, or outlet box, and elsewhere as indicated.

B. Each wire connected to building-mounted devices is not required to be numbered at the device if the wire's color is consistent with the associated wire connected and numbered within the panel or cabinet.

C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
   1. Individual number wiring conductors connected to terminal strips and identified each cable or wiring group being extended from a panel or cabinet to a building. The mounted device shall be identified with the name and number of devices as shown.
   2. Label each unit and field within distribution racks and frames.
   3. Cable ID Example



   4. Building # - The building number is assigned to the building if multiple buildings exist.
      Floor # - Will be incorporated into the TDR #
      TDR #—Begin with 1A through 1Z for the 1st Floor, 2A, and so on, per the floor the cabling is on.
      Patch Panel #-1 through however many patch panels there are.
      Port #-1 -48 for each patch panel.
   5. Cable ID Example for Small Clinics.



D. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-B.1.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 271100
Equipment Room Fittings

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of the following Division 26 sections apply to this section.
   1. Basic electrical requirements
   2. Basic electrical materials and methods
   3. Grounding, earthing, and bonding.

B. Standards
   1. Minimum equipment room specifications shall comply with the 2010 AIA Guidelines for Design and Construction of Health Facilities.
   2. Minimum recommended room sizes are requirements, not suggestions.
   3. Enterprise IS Architecture (EISA) maintains several documents related to standards. The primary standards list is the EISA Standards 2010—Master List. Occasionally, specific standards for an area need to be broken out.

1.2 SUMMARY

A. This Section details the facilities design and operations standards for Intermountain Health Care's Data Rooms (TEC) and data closets (TDR).

1.3 COMMON REQUIREMENTS

A. Rack layout and mounting
   1. Standard room layouts are located on the plans.

B. Rack and wall mounting locations.
   1. Rack and wall space use is pre-designated at the design stage. Before mounting any equipment on a wall or in a rack, the location must be verified by the Div 27 subcontractor and Data Center Operations.

C. All Data Centers, TECs, TSERs, TDRs, Cabinets, and Clam Shells must be secured with either a Card Reader, Electronic Key, or a secure device that is recordable and auditable.

1.4 DEFINITIONS

A. Data Center – Major computer/technology/network facilities providing a significant percentage of the data and application services for the enterprise.

B. Data Rooms TEC (Technology Equipment Center) Purpose-built buildings or rooms that provide a local facility or region with a communications point of presence and some data and applications services.

C. TSER (Telecommunications Service Entrance Room) – Houses the point at which data and voice circuits and services enter the facility and outdoor cabling interfaces with the building infrastructure. Typically, the TSER will be in the TEC.

D. Data Closets – (TDR) Technology Distribution Room) – Specific location within a facility that provides communication services for a specific area (floor, wing, office area) of that facility only. A secure, flexible, and easily managed location for structured cabling systems, network electronics, clinical systems, nurse call systems, and other technology and communications equipment.

E. Wall Mountable Cabinets – Specific location within a facility that provides communication services for a specific area when there is no available space for a

TDR within that space only. A secure, flexible, and easily managed location for structured cabling systems, network electronics, clinical systems, nurse call systems, and other technology and communications equipment.

PART 2 - TECHNOLOGY ROOM SPECIFIC REQUIREMENTS

2.1 TECHNOLOGY EQUIPMENT CENTER (TEC)

A. Each Hospital will have a dedicated TEC, which will serve as the main communications point of presence and provide data and application services for the local facility or region. The TEC houses the core networking equipment, application servers, and data storage devices that serve the buildings on the campus. The Telecommunications Service Entrance Room (TSER) will be in the same room.

2.2 TEC IN HOSPITALS

A. Physical Construction
   1. The TEC should be in an area easily accessible for equipment delivery and high traffic without disturbing patient care.
   2. The size of the TEC will be based on the number of cabinets required to support the campus, plus 30% growth.
   3. TEC should at a minimum be sized to house the following:
      a. 13 – Data Cabinets
      b. 3 – in-row cooling units, e.g., Liebert CRV
      c. 2 – in-row UPS units
      d. 2 post-patching field for inter-TEC cabinets connections for both copper and fiber.
      e. Wall space for inter TEC electrical distribution panels, transformers, and MBPs.
   4. Walls will be constructed from the floor to the deck and completely sealed from surrounding spaces.
      a. All usable wall space will be covered by ¾” x 4 ’ x 8’ Grade AC fire-rated plywood, with a minimum of 50% of wall space covered in ¾” fire-rated plywood.
      b. Fire-rated plywood shall be painted with bright white fire-resistant paint.
      c. c. Paint must not cover the fire rating stamp on the plywood. One stamp per piece of plywood must be taped off so that it cannot be painted.
      d. Mount 6” AFF
   5. The TEC should not have a ceiling other than an exposed structure.
   6. Static Dissipative Tile is required in the TEC.
   7. The door to the TEC shall be 8’-0” x 4’-0” to accommodate the cabinet height.
   8. The walls of the TEC should not have any windows installed.
   9. The TEC will not have infrastructure that serves other trades passing through the TEC, other than that infrastructure that serves the TEC
   10. All pressurized supply piping and drain piping will have drip pans or other means installed to contain any failure of these systems.

B. Layout
   1. Cabinets will be laid out in a cold isle configuration.
   2. All isles, inside and outside, will be a minimum of 4’ wide
   3. Containment will be installed, including removable ceiling panels and isle doors.

C. Electrical
   1. The electrical distribution system will follow an A (BLUE) – B (RED) design.
   2. A dedicated UPS will back up each system A (BLUE) and B (RED).
   3. Source A shall be supplied by a dedicated emergency circuit backed up by a dedicated UPS.
   4. Maintenance Bypass Wraparound or equivalent shall be installed.

5. Source B shall be supplied by a dedicated emergency circuit from a different ATS system from Source A and backed by a dedicated UPS.
6. Maintenance Bypass Wraparound or equivalent shall be installed.
7. Cabinet 0utlet type is L21-30
8. Provide convenience outlets around the room.
9. All power is to be run in conduit.
10. Lighting will be installed above each isle and be supplied by an emergency circuit.

D. Mechanical
1. The mechanical system will be a precision cooling solution installed in an in-row, N+1 configuration designed to maintain 72 degrees F at mid-cabinet.
2. The mechanical system will be redundant and concurrently maintainable, including on the electrical supply.
3. The system shall meet engineering specifications for the room at 110 degrees outside air at 4500 feet above sea level.
4. Chilled water, DX (Air Cooled), and Glycol (30% polyethylene glycol to water) are all acceptable cooling strategies.
5. The GC, Mechanical Engineer, and Mechanical Contractor are responsible for the complete installation of the cooling equipment and auxiliary devices included with it. Auxiliary equipment includes, but is not limited to, in-row temperature sensors, leak detection, and local or remote monitoring hardware.

E. Security
1. Doors will be fitted with an auditable card reader.
2. Doors will have an electronic key cylinder installed.

F. Fire System
1. A pre-action dry pipe fire system will be installed.
2. Sprinkler fuses will be rated at 200 degrees F or higher, whichever is allowed.
3. Sprinklers should be protected from accidental activation.
4. The facility system will provide the primary fire detection system.
5. The secondary detection system is a VESDA system monitored by the Lake Park Data Center.

G. Monitoring
1. The Eaton Foreseer system will monitor all critical systems.
2. Foreseer cables will be run to all UPSs, cooling units, and TDRs.
3. One Cat 6a F/UTP cable to each UPS.

2.3 TEC IN CLINICS AND OFFICE BUILDINGS

A. Clinics and Offices will have a room that serves as a TEC and TDR. This room will be sized to accommodate its multifunctionality.

B. TEC size will be 12’ x 16’

2.4 TEC/TDR IN CLINICS

A. Physical Construction
1. TDRs should be in a central location off the main corridor, away from patient areas.
2. TDRs should be stacked from floor to floor.
3. TDR size will be at least 12’ x 16’.
4. Walls will be constructed from the floor to the deck and completely sealed from surrounding spaces.
   a. All usable wall space will be covered by ¾” x 4 ’ x 8’ Grade AC fire-rated plywood, with a minimum of 50% covered in ¾” fire-rated plywood.
   b. Fire-rated plywood shall be painted with bright white fire-resistant paint.
   c. c. Paint must not cover the fire rating stamp on the plywood. One stamp per piece of plywood must be taped off so it cannot be painted.

   d. Mount 6” AFF
5. The TDR should not have a ceiling other than an exposed structure.
6. Flooring can be Static Dissipative Tile or Epoxy Paint.
7. A 3’-0” x 7’0” door is required.
8. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.

B. Layout
   1. Racks in a single row with the front being the cold isle.
   2. The front of the racks should face the door.

C. Electrical
   1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
   2. A dedicated UPS will back up System A(BLUE).
   3. System B(RED) will be from a dedicated Emergency or Utility circuit.
   4. The outlet type is L6-30 and L5-20.
   5. Provide convenience outlets around the room.
   6. All power is to be run in conduit.
   7. Lighting will be installed above each isle.

D. Mechanical
   1. TDRs will have redundant cooling.
      a. Primary cooling is from the facility cooling system via a dedicated source.
      b. Secondary cooling is from a standalone split or ceiling mount source.
      c. The secondary system will be fed from the facility generator equipment electrical source if available.
      d. The Mechanical system will be designed to maintain 72 degrees F at mid rack.
      e. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.

E. Security
   1. Doors will be fitted with an auditable card reader.
   2. Doors will have an electronic key cylinder installed.

F. Fire System
   1. TDRs will utilize the facility's fire detection and suppression systems.
   2. Sprinkler heads should have a 200-degree fuse.
   3. Sprinklers should be protected from accidental activation.

G. Monitoring
   1. TDRs will be monitored using Eaton/Foreseer.
   2. Run 3 foreseer cables to each TDR.
   3. One Cat6a F/UTP cable to each UPS.

2.5 TEC/TDR IN OFFICES

A. Physical Construction
   1. TDRs should be in a central location off the main corridor.
   2. TDRs should be stacked from floor to floor.
   3. TDR size will be at least 12’ x 16’.
   4. Walls will be constructed from the floor to the deck and will be completely sealed from surrounding spaces.
      a. All usable wall space will be covered by ¾” x 4 ’ x 8’ Grade AC fire-rated plywood, with a minimum of 50% of wall space covered in ¾” fire-rated plywood.
      b. Fire-rated plywood shall be painted with bright white fire-resistant paint.
      c. c. Paint must not cover the fire rating stamp on the plywood. One stamp per piece of plywood must be taped off so that it cannot be painted.
      d. Mount 6” AFF

5. The TDR should not have a ceiling other than an exposed structure.
6. Flooring can be Static Dissipative Tile or Epoxy Paint.
7. A 3’0” x 7’0” door is required.
8. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.

B. Layout
1. Racks in a single row with the front being the cold isle.
2. The front of the racks should face the door.

C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
2. A dedicated UPS will back up System A(BLUE).
3. System B(RED) will be from a dedicated utility circuit.
4. The outlet type is L6-30 and L5-20.
5. Provide convenience outlets around the room.
6. All power is to be run in conduit.
7. Lighting will be installed above each row.

D. Mechanical
1. TDRs will have a redundant cooling system designed to maintain 72 degrees F at mid rack.
   a. Primary cooling is from the facility cooling system via a dedicated source.
   b. Secondary cooling is from a standalone split or ceiling mount source.
      1) the secondary system will be fed from the facility generator equipment electrical source if available.
   c. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.

E. Security
1. Doors will be fitted with an auditable card reader.
2. Doors will have an electronic key cylinder installed.

F. Fire System
1. TDRs will utilize the facility's fire detection and suppression systems.
2. Sprinkler heads should have a 200-degree fuse.
3. Sprinklers should be protected from accidental activation.

G. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
2. Run 3 foreseer cables to each TDR.
3. One Cat 6a F/UTP cable to each UPS.

2.6 TECHNOLOGY DISTRIBUTION ROOM (TDR)

A. There shall be a minimum of one TDR on each floor of the facility. TDRs shall be provided throughout the facility as necessary to meet the 292’ (90-meter) maximum cable distance. The TDR is located on each floor within a facility to house equipment and cabling and provide communication and technology services for a specific area of that facility. Based on the different needs of different facilities, the TDRs will be broken down into three categories: hospitals, Clinics, and Office spaces.

2.7 TDR IN HOSPITALS

A. Physical Construction
1. TDRs should be in a central location off a main corridor and away from patient areas.
2. TDRs should be stacked from floor to floor.
3. TDR size will be at least 14’ x 16’.

4. Walls will be constructed from the floor to the deck and will be completely sealed from surrounding spaces.
   a. All usable wall space will be covered by ¾” x 4 ’ x 8’ Grade AC fire-rated plywood, with a minimum of 50% of wall space covered in ¾” fire-rated plywood.
   b. Fire-rated plywood shall be painted with bright white fire-resistant paint.
   c. c. Paint must not cover the fire rating stamp on the plywood. One stamp per piece of plywood must be taped off so that it cannot be painted.
   d. Mount 6” AFF
5. The TDR should not have a ceiling other than an exposed structure.
6. Flooring can be Static Dissipative Tile or Epoxy Paint.
7. A 3’0” x 7’0” door is required.
8. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.

B. Layout
   1. Racks will be in a cold isle configuration.
   2. Two rows with the cold aisle in the middle.

C. Electrical
   1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
   2. Each system A(BLUE) and B(RED) will be backed up by a dedicated UPS.
   3. The outlet type is L6-30 and L5-20.
   4. Provide convenience outlets around the room.
   5. All power is to be run in conduit.
   6. Lighting will be installed above each isle.

D. Mechanical
   1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
      a. Primary cooling is from the facility cooling system via a dedicated source.
      b. Secondary cooling is from a standalone split or ceiling mount source.
      c. The secondary system will be fed from the facility generator equipment electrical source if available.
      d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.

E. Security
   1. Doors will be fitted with an auditable card reader.
   2. Doors will have an electronic key cylinder installed.

F. Fire System
   1. TDRs will utilize the facility's fire detection and suppression systems.
   2. Sprinkler heads should have a 200-degree fuse.
   3. Sprinklers should be protected from accidental activation.

G. Monitoring
   1. TDRs will be monitored using Eaton/Foreseer.
   2. Run 3 foreseer cables to each TDR.
   3. One Cat 6a F/UTP cable to each UPS.

2.8 TDR IN CLINICS

A. Physical Construction
   1. TDRs should be in a central location off a main corridor and away from patient areas.
   2. TDRs should be stacked from floor to floor.
   3. TDR size will be at least 10’ x 12’.
   4. The TDR size in Clinics is 6000 sq. ft. or less, and it will be at least 8’ x 8’ or as approved by the Intermountain IS/IT team based on the functional layout of the TDR equipment.
   5. TDR size in Clinics for Tenants Demarc will be at least 5’ x 5’.

6. Walls will be constructed from the floor to the deck and will be completely sealed from surrounding spaces.
   a. All usable wall space will be covered by ¾” x 4 ’ x 8’ Grade AC fire-rated plywood, with a minimum of 50% of wall space covered in ¾” fire-rated plywood.
   b. Fire-rated plywood shall be painted with bright white fire-resistant paint.
   c. c. Paint must not cover the fire rating stamp on the plywood. One stamp per piece of plywood must be taped off so that it cannot be painted.
   d. Mount 6” AFF
7. The TDR should not have a ceiling other than an exposed structure.
8. Flooring can be Static Dissipative Tile or Epoxy Paint.
9. A 3’-0” x 7’-0” wide door is required.
10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.

B. Layout
   1. Racks in a single row with the front being the cold isle.
   2. The front of the racks should face the door.

C. Electrical
   1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
   2. A dedicated UPS will back up System A(BLUE).
   3. System B(RED) will be from a dedicated utility circuit.
   4. The outlet type is L6-30 and L5-20.
   5. Provide convenience outlets around the room.
   6. All power is to be run in conduit.
   7. Lighting will be installed above each isle.

D. Mechanical
   1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
      a. Primary cooling is from the facility cooling system via a dedicated source.
      b. Secondary cooling is from a standalone split or ceiling mount source.
      c. The secondary system will be fed from the facility generator equipment electrical source if available.
      d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.

E. Security
   1. Doors will be fitted with an auditable card reader.
   2. Doors will have an electronic key cylinder installed.

F. Fire System
   1. TDRs will utilize the facility's fire detection and suppression systems.
   2. Sprinkler heads should have a 200-degree fuse.
   3. Sprinklers should be protected from accidental activation.

G. Monitoring
   1. TDRs will be monitored using Eaton/Foreseer.
   2. Run 3 foreseer cables to each TDR.
   3. One Cat 6a F/UTP cable to each UPS.

2.9 TDR IN OFFICES

A. Physical Construction
   1. TDRs should be in a central location off the main corridor.
   2. TDRs should be stacked from floor to floor.
   3. TDR size will be at least 10’ x 12’.
   4. Walls will be constructed from the floor to the deck and will be completely sealed from surrounding spaces.

a. All usable wall space will be covered by ¾” x 4 ’ x 8’ Grade AC fire-rated plywood, with a minimum of 50% of wall space covered in ¾” fire-rated plywood.
b. Fire-rated plywood shall be painted with bright white fire-resistant paint.
c. c. Paint must not cover the fire rating stamp on the plywood. One stamp per piece of plywood must be taped off so that it cannot be painted.
d. Mount 6” AFF

5. The TDR should not have a ceiling other than an exposed structure.
6. Flooring can be Static Dissipative Tile or Epoxy Paint.
7. A 3’0” x 7’0” door is required.
8. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.

B. Layout
1. Racks in a single row with the front being the cold isle.
2. The front of the racks should face the door.

C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
2. A dedicated UPS will back up System A(BLUE).
3. System B(RED) will be from a dedicated utility circuit.
4. The outlet type is L6-30 and L5-20.
5. Provide convenience outlets around the room.
6. All power is to be run in conduit.
7. Lighting will be installed above each isle.

D. Mechanical
1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
a. Primary cooling is from the facility cooling system via a dedicated source.
b. Secondary cooling is from a standalone split or ceiling mount source.
c. The secondary system will be fed from the facility generator equipment electrical source if available.
d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.

E. Security
1. Doors will be fitted with an auditable card reader.
2. Doors will have an electronic key cylinder installed.

F. Fire System
1. TDRs will utilize the facility's fire detection and suppression systems.
2. Sprinkler heads should have a 200-degree fuse.
3. Sprinklers should be protected from accidental activation.

G. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
2. Run 3 foreseer cables to each TDR.
3. One Cat 6a F/UTP cable to each UPS.

2.10 WALL MOUNT CABINET

A. Physical Condition
1. The wall mount cabinet should only be used when there is no space for a TDR.

B. Electrical
1. Power should be run into the back of the cabinet.

C. Mechanical
1. The cabinet should have a factory fan installed.

D. Security
   1. The door will have an electronic key cylinder installed.

PART 3 - EXECUTION

3.1 COMMON REQUIRED CHARACTERISTICS FOR TDR, TEC, & TSER

A. SECURITY - COMMON
   1. Any visitor, vendor, or contractor requiring access to a Technology Room who does not have appropriate approvals or clearances must be escorted by a properly credentialed tech from the appropriate system.
   2. The main technology equipment shall be secured in a dedicated, locked Technology Room.
   3. Unused access jacks should be disconnected from the patch panels, and unused switch ports disabled.
   4. Technology Rooms shall be dedicated to the data and telecommunications functions.
   5. Access to the Technology Room shall be restricted to authorized service personnel. It shall not be shared with building services that may interfere with the main networking interfaces, the networking equipment, the application servers, the data storage devices, and the telecommunications equipment systems.
   6. Technology Rooms shall not be used for building maintenance services, custodial services, or be used for general storage.
   7. Security cameras may be installed in each Technology Room at the owner's preference.
      a. At the back wall facing the door, at the end of each row of equipment racks, directed so that you do not see the equipment in the racks.
      b. In electrical and mechanical rooms serving the Technology Room
      c. Approved camera manufacturers: Axis and Bosch
   8. Access to a Technology Room shall be restricted and controlled by an auditable access control system. The access control system shall comply with the requirements of this document.
   9. An auditable badge reader system must secure all secure data areas.
      a. Refer to plans or quotes for detailed information.
      b. Approved supplier: Intermountain Lock and Security Supply /
      c. 3106 S Main St / Salt Lake City, UT 84115 / 801-486-0079
      d. Owner of security locks and badge readers:
      e. Intermountain Healthcare Data Center
      f. For programming on the Medeco XT Electronic Keys, contact:
      g. Intermountain Healthcare Data Center

B. PHYSICAL ENVIRONMENT
   1. The Technology Room shall be in a dry area not subject to flooding. It should be as close as possible to the electrical service room to reduce the length of the bonding conductor to an electrical grounding system.
   2. The Technology Room shall be in an accessible, non-sterile area.
   3. Access to the Technology Room shall be directly off a corridor and not through another space.
   4. The Technology Room shall be located to avoid large ducts, beams, and other building elements that may interfere with proper cable routing and may limit future access.
   5. Mechanical and electrical equipment or fixtures not directly and exclusively related to the support of the Technology Room shall not be installed in, pass through, or enter the Technology Room.
   6. Technology rooms shall not be located on exterior walls.
   7. Technology rooms shall not have windows or other exterior openings.

3.2 TECHNOLOGY DISTRIBUTION ROOM (TDR) / DATA CLOSET

A. ELECTRICAL ENVIRONMENT
1. Separation from sources of EMI shall be in accordance with ANSI/TIA/EIA-569-C and local codes.
2. Communication grounding/earthing, and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-C, or both, be observed throughout the entire cabling system.
   a. All racks, equipment frames, furniture, flooring, and ductwork within the IT space shall be bonded to the Central Ground bar provided and installed by Division 26.
      1) No AC electrical equipment bonding will be done at the Central Ground Bar. AC electrical grounding and bonding will be done according to the NEC.
3. Some TDRs will require redundant power and data feeds. See plans and drawings.
4. Lighting in the TDRs should be at least 500 lx (50-foot candles) at the lowest point of termination.
   a. Light switch should be easily accessible when entering the room.
   b. Lighting will be fed from the generator system or have fixtures with battery backup.
5. A minimum of two dedicated duplex or two dedicated simplex electrical outlets, each on a separate 120V 20A circuit, should be provided for equipment power.
6. Additional convenience duplex outlets should be placed around the perimeter walls at 1.8 m (6 ft) intervals.
   a. Only twist lock receptacles will be used for rack power points. Type L-6-30R for 208 volts and type NEMA L-5-20R for 120 volts.
7. All power originates from the facility's generator backup system, with one system (A-B) originating from the critical system.
8. All circuits serving the TDR and its equipment shall be dedicated to serving the TDR.
9. TDRs shall be connected between all technology rooms by a backbone of insulated, 6 (minimum) to 3/0 AWG stranded copper cable. Division 26 shall provide and install this cable.

B. MECHANICAL ENVIRONMENT
1. Reliable cooling shall be provided.
   a. Based on the criticality tiering structure, individual rooms may require redundant, concurrently maintainable cooling systems.
   b. Tier structure level shall be determined from the design guide.
2. Heat load shall be calculated at 4KW per equipment rack
3. The TDR's temperature and humidity shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.

C. EQUIPMENT
1. Each TDR shall be connected to the TEC (Technology Equipment Center) to provide a building-wide network and communications system.
2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded to a Telecommunication Grounding Bus Bar

3.3 TECHNOLOGY EQUIPMENT CENTER (TEC) / DATA ROOM

A. ELECTRICAL ENVIRONMENT
1. The TDR and TEC electrical environments shall match the following exceptions:
2. All circuits and equipment serving the TEC shall be dedicated to serving the TEC.

B. MECHANICAL ENVIRONMENT
1. TEC and TSER have the same mechanical environment.
2. Reliable cooling shall be provided.
3. Heat load shall be calculated at 4KW per equipment rack.
4. The TEC's temperature and humidity shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.

C. EQUIPMENT
1. Each TEC shall be connected to the TSER (Telecommunications Service Entrance Room) to provide an enterprise-wide network and communications system.
2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded to a Telecommunications Main Grounding Bus Bar.

3.4 TELECOMMUNICATION SERVICE ENTRANCE ROOM (TSER) / D-MARC

A. PURPOSE
1. The TSER (Telecommunications Service Entrance Room) equipment subsystem shall consist of shared (common) electronic communications equipment in the
2.
3. TEC or the TSER must interface this equipment and distribution hardware with the transmission media of the enterprise-wide Area Network (WAN) infrastructure.
4. The TSER shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
   a. Note that the AIA/State guidelines specify that the minimum size for a TSER is 12’ by 14’.
   b. Doors shall swing out of the room to provide maximum available space and rapid egress.
      1) Exception: where prohibited by fire or safety code.
5. The TSER shall be dedicated to the telecommunications function.

B. MECHANICAL ENVIRONMENT
1. Reliable cooling and heating shall be provided.
2. The TSER's temperature and humidity shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.

C. EQUIPMENT
1. The TSER (Telecommunications Service Entrance Room) shall be connected to the specified WAN equipment to provide connectivity to the enterprise-wide network and communications system.
2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded to a Telecommunications Main Grounding Bus Bar.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 271116
Cabinets, Racks, Frames, and Enclosures

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Cabinets and racks specifications are in TIA569-C and the plans' ET pages.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

A. OPEN RACKS
1. For rack-mounted installations in a telecommunications room, the installer shall use a 19-inch by 3-inch-deep equipment rack.
2. Equipment Rack 19" X 8', 52 RU, Black – Chatsworth 55053-715
3. Equipment Rack 19” X 7’, 45 RU, Black – Chatsworth 55053-703
4. Exception: Where other size cabinets are specified by the design team at the owner’s direction
5. All equipment racks must be bolted to the floor for seismic support.

B. WALL MOUNTED RACK
1. Wall Mounted Rack 53.6” H x 17” D, 26RU, Black – Chatsworth 11807-718
2. Heavy Duty Swing Gate – Chatsworth 12795-701

C. WIRE MANAGERS
1. Part Numbers
   a. Vertical Wire Manager, Double Sided, Black 10” wide x 8’ tall – Chatsworth 40096-715
   b. Vertical Wire Manager, Double Sided, Black 10” wide x 7’ tall – Chatsworth 40096-703
   c. Horizontal Wire Manager, 4U – Panduit PR2HF4
2. Typical Standard Layout
   a. The layout is 10” vertical manager, then 19” rack, then 10” vertical manager, then 19” rack, then 10” vertical manager.
   b. Where more than 2 racks are needed, maintain the pattern of 10” vertical wire management on the ends and 10” vertical management between racks.

D. CABINETS
1. Standard Cabinet
   a. DCE 1-Sided Cabinet – 600mm x 1200mm - Vertiv E4562121120001S
   b. DCE 2-Sided Cabinet – 600mm x 1200mm - Vertiv E4562122120001S
   c. DCE 1-Sided Cabinet – 700mm x 1200mm – Vertiv E4572112120001S
   d. DCE 2-Sided Cabinet – 700mm x 1200mm – Vertiv E4572122120001S
   e. Baying Gasket – Baying Gasket Kit – Vertiv E4013
   f. Baying Kit – Baying Hardware Kit – Vertiv E9013
   g. Blanking Panel – Upsite Hotlok 10031 1U
   h. Blanking Panel – Upsite Hotlok – 10033 2U
   i. All cabinets must be bolted to the floor for seismic support.
2. Wall Mount Cabinet
   a. Cube-It – CPI 11996-736 (36” H x 30” D). Or specified size.
   b. Stand Fan and Filter Kit for Cube-It – CPI 40972-001

c. Power strip for Cube-It – CPI 12820-705 (20 Amp – NEMA 5-20P)
d. Vertical Wall Mount Cabinet – Legrand VWMSD-4RU-42-B
e. Vertical Wall Mount Cabinet – Legrand VWMSD-8RU-42-B
f. Fixed Mounting Rail Kit – Legrand VWM-RR-4RU
g. Fixed Mounting Rail Kit – Legrand VWM-RR-8RU
h. Pivoting Mounting Rail Kit – Legrand VWM-PIV-4RU
i. Fan Kits with 115 VAC fans – Legrand VWMFK-115
j. Top Brush Grommet Kit – Legrand VWMBGK
k. Circular Knockout Grommet Kit – Legrand VWMGR-30
l. Vertical Wall-Mount Cabinets - Refrigerated Cabinet 24” – Hubbell IR221APG.
m. Vertical Wall-Mount Cabinets - Refrigerated Cabinet 36” – Hubbell IR321APG.
n. Vertical Wall-Mount Cabinets - Refrigerated Cabinet 48” – Hubbell IR421APG.
o. Air Conditioners – Air conditioner for Hubbell refrigerated cabinets - Hubbell IRAC1

END OF SECTION

SECTION 271119
Termination Blocks and Patch Panels

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of the following Division 26 sections apply to this section.
   1. Basic electrical requirements
   2. Basic electrical materials and methods
   3. Grounding, Earthing, and Bonding

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

A. PATCH PANELS – COPPER
   1. 48 Port CAT 6A Shielded, 1RU Angled Patch Panel with Outlets –
   2. Siemon Z6AS-PA-48A
   3. 48 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets –
   4. Siemon Z6AS-PNL-U48K
   5. 24 Port CAT 6A Shielded, 1RU Plat Patch Panel with Outlets –
   6. Siemon Z6AS-PNL-U24K
   7. 48 Port CAT 6, 2RU Angled Patch Panel, 110 Style – Siemon UP6-A2-48L-RS
   8. 48 Port CAT 6, 2RU Flat Patch Panel, 110 Style – Siemon UP6-F2-48L-RS
   9. 24 Port CAT 6, 1RU Angled Patch Panel, 110 Style – Siemon UP6-A1-24L-RS
   10. 24 Port CAT 6, 1RU Flat Patch Panel, 110 Style – Siemon UP6-F1-24L-RS
   11. 19” Angled Blank Filler Panel, 1U, Black – Siemon PNL-BLNKA-1
      a. Provide blank fillers where appropriate.
   12. 19” Flat Blank Filler Panel, 1U, Black – Siemon PNL-BLNK-1
      a. Provide blank fillers where appropriate.

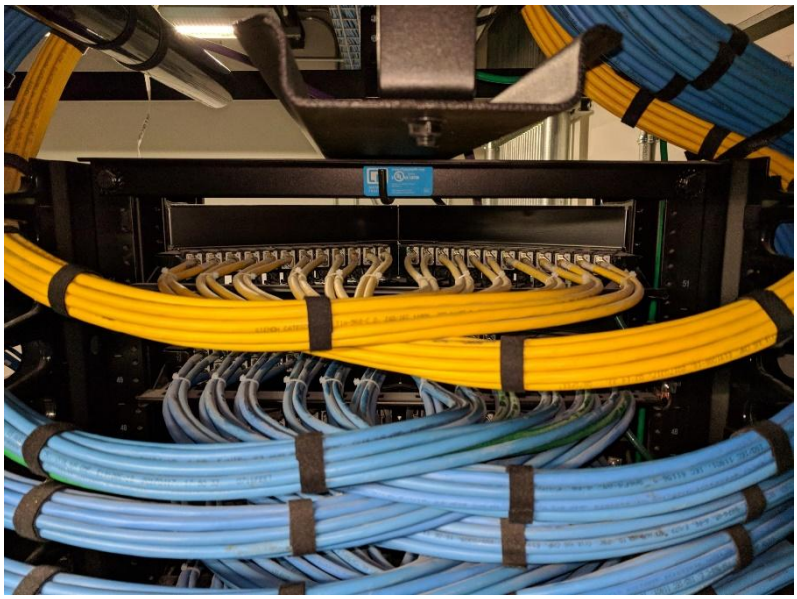
B. PATCH PANELS – FIBER
   1. LightVerse Rack Mount Fiber Enclosure – Siemon LVE-4U-MD-P01A
   2. Lightverse Blank Adapter Plate, Black – Siemon LVA-BLANK-01A
   3. LightVerse LC Splice Cassette - Siemon LVS12-LSUARAB1A
   4. LightVerse Splice Tray – Siemon TRAYHD—1-A
   5. OM4 Splice Cassette – Siemon LVS12-LS-PVRAB1A
   6. Wall Mount Fiber Enclosure – Siemon LVW-M1-01
   7. Lightstack Surface Mount Module Enclosure – Siemon – LSE-01
   8. Lightstack Surface Mount Splice Enclosure – Siemon – LSS-01
   9. Lightstack LC Adapter Plate – Siemon LS-LS12-01C-AQ

PART 3 - EXECUTION

3.1 INSTALLATION

A. For angled patch panels, the terminations shall cross in the back to the opposite path of the patch panel to maximize available cable bend radius.

B. See illustration below in this section:



END OF SECTION

SECTION 271300
Backbone Cabling

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. Section 270528 – Pathways for Communications Systems.

1.2 DEFINITIONS

A. INTRA-BUILDING CABLING
   1. Cable that runs between telecommunications rooms (TRs) inside a building. Can be vertical or horizontal in physical orientation. It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media.

B. INTER-BUILDING / CAMPUS CABLING
   1. A cable that runs between buildings in a campus environment. It is normally a first-level backbone cable beginning at the main cross-connect in the equipment room of the hub building and extending to the intermediate cross-connect in the equipment room of a satellite building. Campus Backbones require an optical fiber cable to be installed to support high-speed data applications.
   2. Customer-owned outside plant (OSP) cabling.

PART 2 - PRODUCTS

1.1 PERMITTED BACKBONE MEDIA

A. Cables allowed for use in the backbone include:
   1. CAT 6A F/UTP Riser, Blue, Data – Siemon 9A6R4-A5-06-R1A
   2. CAT 6A F/UTP Plenum, Blue, Data – Siemon 9A6P4-A5-06-R1A
   3. 50 Pair Category 3 Riser Cable Gray – General Cable 2133161 or equal
   4. 50 Pair Category 3, OSP Rated PE-89, Black, 22 AWG – General Cable 7525637 or equal.
   5. Building Entrance Terminal, 50-Pair, 110 Style Termination – Circa 1880ECA1-50
   6. Fiber Optic Cable, Single-mode, 24 Strand, Armored Indoor/Outdoor Cable, Black – Siemon 9BG8P024L-E201A
   7. Fiber Optic Cable, Single-mode, 24 Strand, Armored, Plenum Cable, Yellow – Siemon 9BC8P024L-E205A
   8. Fiber optic Cable, Single-mode, 48 Strand, Armored Outdoor Cable, Black – Siemon 9PF8C048G-E201A
   9. Fiber Optic Cable, Single-mode, 144 Strand, Armored Outdoor Cable, Black – Siemon 9PF8C144G-E201A
   10. Fiber Optic cable, multi-mode, OM4, 12 Strand, Armored, Riser Cable, Aqua – Siemon 9BC5R012G-T512A (Data Centers must be OM4 or better)
   11. Microfiber

B. The cable shall support voice, data, and imaging applications. All backbone cables' bending radius and pulling strength requirements shall be observed during handling and installation.

C. Multi-pair twisted pair cable is intended to support analog voice applications and shall be tested for continuity only.

D. In addition to meeting the applicable performance specifications, all copper and optical fiber cables shall be appropriate for the environment in which they are installed.

2.2 MEDIA PRODUCTS

A. COPPER
1. The total channel length between the Campus Distributor/Main Cross-connect and any floor Distributor/Horizontal Cross-connect shall not exceed the following length limits for copper cabling:
a. 2,000 m (6,560 ft) for balanced twisted pair for PBX/Class A (100 kHz) applications.
b. 200 m (656 ft) for balanced twisted pair for Class B (≤ 1 MHz) applications.
c. 100 m (328 ft) for balanced twisted-pair categories 6, 6A & 7 (per Backbone segment when providing a two-level Backbone).

B. MULTIMODE OPTICAL FIBER
1. See the Siemon website for supportable fiber distances
a. Laser-qualified 50/125□m multimode fiber optical fiber cables shall follow the following standards: ISO/IEC 11801:2002 OM3, ANSI/TIA-568-C.3, ANSI/TIA-568-C.1 and Telcordia GR-409-CORE, as well as the guaranteed application distances, attenuation, bandwidth, and group index requirements of refraction.
b. Specifications:
1) Shall support 10GBASE-SX for all horizontal workstations, risers, and short length backbone (<300 m) locations.
2) Constructed for overfilled launch (OFL) and restricted mode launch (RML) bandwidth to ensure compatibility with both LED and laser light sources.
3) Have an Aqua Outer Jacket available in cable ratings, including OFNR and OFNP.

C. SINGLE-MODE OPTICAL FIBER
1. See the Siemon website for supportable fiber distances
2. Single-mode optical fiber cable shall only be used for 1st and 2nd Level Backbone applications.
3. All fiber is to fusion-spliced terminations.

PART 3 - EXECUTION

3.1 TOPOLOGY

A. The Backbone cabling shall use a conventional hierarchical star topology.
1. There shall be no more than two (2) levels of cross-connects between the campus distributor/main cross–connect (CD/MC) and any given floor distributor/horizontal cross-connect (FD/HC).
2. From the FD/HC, no more than one cross-connect shall be passed through to reach the CD/MC.

B. Splicing of UTP, F/UTP and S/FTP copper cables is not permitted.

3.2 TYPICAL TDR BACKBONE

A. A typical TDR backbone for a hospital campus shall consist of:
1. Redundant (2 ea.) 24-strand single-mode fiber, each routed in a separate path.
2. One 50-pair copper feed line.

END OF SECTION

SECTION 271500
Horizontal Cabling

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

PART 2 - SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

2.1 SUMMARY

A. This section includes requirements and guidelines for installing F/UTP, ScTP, and Fiber horizontal cabling.
   1. Horizontal cable and its connecting hardware transport signal between the telecommunications outlet/connector and the horizontal cross-connect located in the communications termination room. This cabling and its connecting hardware are called "permanent link," a term used in the testing protocols.

PART 3 - EXECUTION

3.1 HORIZONTAL CABLE

A. Quantity
   1. Two horizontal cables shall be routed to each work area. Cable connected to information outlets shall be CAT6A F/UTP, 4-pair, 100Ω balanced twisted-pair.
      a. A work area is approximately 100 sq. ft. and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
      b. According to current best practice, two (2) standard cables shall be run to each wireless access point location.
      c. One (1) standard horizontal cable may be run to the following locations:
         1) The building controls vendor directs each building control system enclosure.
         2) Each IP Video Surveillance Camera at each of the designated locations.
         3) Each wall phone.
         4) Each wall monitor/display.
   2. For voice or data applications, 4-pair balanced twisted-pair or fiber optic cables shall be run using a star topology from the telecommunications room serving that floor to every individual information outlet. The customer shall approve all cable routes before the installation of the cabling.
   3. Installation interfaces shall be T568B wiring standards.

B. Maximum Length
   1. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft.) from the telecommunications outlets in the work area to the Floor Telecommunications Room.
   2. Distributor/Horizontal Cross-connect (FD/HC) located in the Telecommunication Room.
   3. The combined length of jumpers and patch cords, including equipment cables in the Floor Distributor/Horizontal Cross-connect, shall not exceed 5m (16 ft.).
   4. The maximum length of Work Area equipment cables shall be 5m (16 ft.) If a
   5. MuTOA (Multiple User Telecommunication Outlet) environment exists, then the
   6. Maximum equipment cable shall not exceed 22m (72 ft.) (Lake Park Facility)

7. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

C. Minimum Length
1. It is recommended that a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and the work area. This will provide adequate Insertion Loss/Attenuation for applications over 1 Gig.
2. For installations with consolidation points, a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and the consolidation point, and 5m (16 ft.) between the consolidation point and the work area. This will provide adequate Insertion Loss/Attenuation for applications over 1 Gig.

D. Splice Free
1. Each run of balanced twisted-pair cable between the Floor Distributor/Horizontal Cross-connect in the telecommunication room and the information outlet at the Work Area shall not contain splices.
2. Bridged taps and splices shall not be installed in the horizontal cabling.

E. Protection
1. Horizontal distribution cables shall not be run under slab raceways in damp or wet locations unless they are suitably rated for the environment.
   a. Under-slab conduits that are outside of the building are considered wet locations.

F. Slack -Service Loop – Routing
1. A minimum of 1m (3 ft) should be left in the work area for balanced twisted-pair cables and fiber cables.
2. In telecommunications rooms, a minimum of 3m (10 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types.

3.2 SEPARATION

A. Separation from EMI sources
1. Installation shall comply with BICSI TDMM and TIA/EIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and EMI Source shall be as follows:
   a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 5 inches.
   b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 12 inches.
   c. EMI Source Rating More Than 5 kVA: A minimum clearance of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or EMI Source shall be as follows:
   a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 2-1/2 inches.
   b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 6 inches.
   c. EMI Source Rating More Than 5 kVA: A minimum clearance of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and EMI Source located in grounded metallic conduits or enclosures shall be as follows:
   a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 2 inches.
   b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 3 inches.
   c. EMI Source Rating More Than 5 kVA: A minimum clearance of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, five kVA or 1 HP and Larger: A minimum clearance of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum clearance of 5 inches

B. Other Clearances

1. Horizontal pathways used for telecommunications cabling shall be dedicated for telecommunications use and not shared by other building services.
2. A minimum of 75 mm (3 in) shall be observed between the cable supports and the false ceiling in a false ceiling environment.

3.3 PATHWAY

A. Cable Tie Wraps
1. Cable Tie Wraps are prohibited as a pathway device or support.
2. Tie Wraps shall only be used to provide strain relief at termination points.
3. Tie wraps shall not be over-tightened to the point of deforming or crimping the cable sheath.

B. Constraints
1. Horizontal cables shall be installed in “dry” locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables.
   a. If cabling is intentionally or unintentionally exposed to water or otherwise coated with or exposed to direct contact with solvents, paints, adhesives, sealants, or other third-party materials, Siemon will not warranty the cabling product, or if after the warranty has been issued, it would become void. Therefore, any cabling that has been exposed as listed above must be removed and replaced.
2. Horizontal pathways shall be installed or selected so that the minimum bend radius of horizontal cables remains within the manufacturer's specifications during and after installation.
3. New construction requires a minimum of a 1” diameter conduit. Existing conduits will require reducing the number of cables placed in them to meet the required fill ratio.
   a. The Contractor shall observe the bending radius and pulling strength requirements of the 4-pair balanced twisted-pair and fiber optic cable during handling and installation.
      1) 4-Pair UTP, F/UTP, S/FTP bend radius = 4 times outside diameter of cable under no-load conditions. 8 times the outside diameter under load (pulling 110 N/25 lbf.) conditions.
      2) Multi-pair or Hybrid cable bend radius = 10 times the outside diameter under all conditions.
      3) 2-Fiber and 4-Fiber cables bend radius = 25mm (1 in.) under no-load conditions. 50mm (2 in.) under load (pulling 222 N 50 lbf)
4. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
5. Cable that passes through non-Intermountain Health spaces must be installed in conduit.
6. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
7. Do not install bruised, kinked, scored, deformed, abraded, or otherwise damaged cable. Do not splice cable between termination, tap, or junction points. If the cable is damaged during installation, remove and discard it and replace it with a new cable.
8. During Cold-Weather Installation, bring the cable to room temperature before de-reeling. Heat lamps shall not be used for heating.

C. Capacity
1. The number of horizontal cables placed in a cable support or pathway shall be limited to the number of cables that will not alter the geometric shape of the cables.
2. Maximum pathway (cable tray/basket tray/wireway) capacity shall not exceed a calculated fill ratio of 50% to a maximum of 75 mm (3 in) inside depth.
3. Maximum conduit pathway capacity shall not exceed 40% fill. However, perimeter and furniture fill are limited to 60% fill for moves and changes. A 40% fill ratio is the maximum fill for CAT6A F/UTP cables.
4. All unused cables shall be removed
   a. Or labeled at both ends, designating future purpose and locations of each end.

Cable Tray Size [W x D] mm (in.)	Cable O.D. - CAT 6A Shielded (.29 in.)		
	7.4mm (0.29 in.)	8.4mm (0.33 in.)	8.9mm (0.35 in.)
304x101 (12 x 4)	363	280	249
457x101 (18 x 4)	545	20	374
610x101 (24 x 4)	726	561	498
304x152 (12 x 6)	545	420	374
457x152 (18 x 6)	817	631	561
610 x 152 (24 x 6)	1099	841	748

END OF SECTION

SECTION 271513
Copper Cable

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this section

1.2 PALLETTE

A. Color palette shall be in accordance with Section 270553

1.3 SUMMARY

A. This Section covers approved F/UTP / UTP cable types

B. All systems except for Nurse Call shall be CAT6A F/UTP unless a written deviation has been approved.

C. CAT6A UTP and CAT6A F/UTP shall not be mixed on the same campus.

D. This cable shall be used for both voice and data applications and shall be plenum-rated where required by code

E. All Nurse Call cables shall be CAT6 UTP.

PART 2 - PRODUCT

2.1 APPROVED PRODUCT

A. TYPE 6A F/UTP (foil over unshielded twisted pair) - Siemon
   1. CAT 6A F/UTP Riser, (CMR) – Siemon 9A6R4-A5-(XX)-R1A
   2. CAT 6A F/UTP Plenum, (CMP) – Siemon 9A6P4-A5-(XX)-R1A
      a. (XX) = Color – 06, Blue – 05, Yellow – 09, Orange

B. TYPE 6 UTP (unshielded twisted pair) – Siemon – Nurse Call only
   1. CAT 6 UTP Riser, (CMR) – Siemon 9C6R4-E3-09-RXB
   2. CAT 6 UTP Plenum, (CMP) – Siemon 9C6P4-E3-09-RXA

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 271543
Faceplates and Connectors

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DEFINITION

A. Work-Area Cabling
   1. The work area is comprised of work area outlets/connectors, faceplates, outlet boxes, and equipment cords. It acts as the interface to the horizontal cabling from the horizontal cross-connect (HC) to telephone, network equipment, wireless access points (WAP), and OIP devices.

PART 2 - PRODUCT

2.1 OUTLETS

A. Category 6A Shielded Jack – Siemon Z6A-S(XX)
   1. Use (XX) to specify color.
   2. Universal design allows the same outlet to be mounted in a flat or angled orientation.

B. UltraMAX Category 6 Jack – Orange – Nurse Call – Siemon U6-H09NS

C. Category 6A Z-Plug WO Latch Protector – Siemon ZP1-6AS-(00)s

D. Voice Outlet, Single Gang Faceplate, White W/Wall Hung Phone W/6A Insert – Siemon MX-WP-Z6AS-SS

2.2 FACEPLATES/BOXES

A. 10G Single Gang Faceplate, White, 4 Position – Siemon 10GMX-FP-04-02

B. MAX Single Gang Faceplate, White – Siemon MX-FP-S-(XX)-02
   1. USE (XX) to specify the number of ports.

C. MAX Single Gang Faceplate, Stainless Steel, 4 Position, with Label Holder – Siemon MX-FP-S-04-SS-L
   1. To be used in the Operation Rooms

D. Surface Mount Box, White, 2 Position – Siemon MX-SMZ2-02

E. Furniture Faceplate, Black – Siemon MX-UMA-01

F. Blank Insert, White – Siemon MX-BL-02

G. Blank Insert, Black – Siemon MX-BL-01

H. Conference Room Table Inserts shall include an HDMI port.

PART 3 - EXECUTION

3.1 WORK AREA TERMINATION

A. All balanced twisted-pair cables wired to the telecommunications outlet/connector shall have 4-pairs terminated in eight-position modular outlets in the work area. All pairs shall be terminated.

B. Outlet/connector back boxes shall be a minimum 4-11/16 square box (4-11/16” x 4-11/16” x 3”) with a minimum single gang 5/8” mud ring for new construction to accommodate the CAT6A connectors.

C. All outlets need to be installed in the angled position.

END OF SECTION

SECTION 271619
Patch Cables

PART 1 - GENERAL

1.1 SUMMARY

A. This section is issued as a guide for patch cable installations in the Data Center, wiring closets (TDR), user areas where patch cables are required for connectivity to IP and TDM phones, and IP data connectivity needs for Intermountain Healthcare. All patch cables will support voice, data, and imaging applications within the Intermountain Healthcare Enterprise.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

A. Patch Cable, CAT 6A Shielded Skinny- Siemon SP6A-S (XX)-(XX)
   1. Use 1st (xx) to specify length. Use 2nd (xx) for color.

B. Patch Cable, CAT 6, Orange – Siemon MC6-(XX)-09-28
   1. Use (xx) to specify length. For use with NURSE CALL only.

C. Patch Cable, Fiber, Single mode Duplex W/LC Connectors, Yellow – Siemon FJ2-LCULCUL-(xx)
   1. Use (xx) to specify length.

D. Patch Cable, Fiber, Multimode Duplex W/LC Connectors, Aqua – Siemon FJ2-LCLC5V-(xx)AQ
   1. Use (xx) to specify length. For use in the Data Center.

PART 3 - EXECUTION

3.1 PALLETTE

A. Patch Cable Color Codes
   1. The Intermountain Healthcare Enterprise standard for patch cable color is in Section 270553.
   2. The patch cable color shall match the feed cable color to identify the service provided.

B. Contractor furnished.
   1. All patch cables for the TECs and TDRs shall be included in the low-voltage contract and will be required to match or exceed the existing level of the installed structured cabling system.
   2. All patch cables for the user areas shall be owner-furnished and will be required to match or exceed the existing level of the installed structured cabling system.
   3. All patch cables shall be Owner-installed.
   4. The quantity of patch cables the low-voltage contractor provides shall be specified in the plans.
      a. 50% 5ft – 40% 7ft – 5% 10ft – 5% 15ft

END OF SECTION

SECTION 27 41 33
MASTER ANTENNA TELEVISION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Master antenna television systems using direct broadcast satellite service or community cable as the signal source. Provide broadband coaxial cabling for distributing television signal to user interface outlets.

1.3 DEFINITIONS

A. Broadband: For the purposes of this Section, wide bandwidth equipment or systems that can carry signals occupying in the frequency range of 54 to 1002 MHz. A broadband communication system can simultaneously accommodate television, voice, data, and many other services.

B. Carrier: A pure-frequency signal that is modulated to carry information. In the process of modulation, it is spread out over a wider band. The carrier frequency is the center frequency on any television channel.

C. CATV: Community antenna television; a communication system that simultaneously distributes several different channels of broadcast programs and other information to customers via a coaxial cable.

D. dBmV: Decibels relative to 1 mV across 75 ohms. Zero dBmV is defined as 1 mV across 75 ohms. dBmV = 20 log 10(V_1/V_2) where V_1 is the measurement of voltage at a point having identical impedance to V_2 (0.001 V across 75 ohms).

E. Headend: The control center of the master antenna television system, where incoming signals are amplified, converted, processed, and combined into a common cable along with any locally originated television signals, for transmission to user-interface points. It is also called the "Central Retransmission Facility."

F. RF: Radio frequency.

G. TV Outlet: End point of Contractor's responsibility for Work of this Section. TV outlets are the 75-ohm terminals on device plates.

1.4 SYSTEM DESCRIPTION

A. System shall consist of direct broadcast satellite service from the existing headend through a new coaxial cable distribution system.

B. Headend processing equipment shall be owner provided.

C. Distribution of community television service signals. This will include coordinating with Owner's selected service provider for processing the signals as needed to provide specified services combined into a single-feed point ready for connection into the distribution system. Obtain signal levels, and noise and distortion characteristics from service provider as the point of departure for system layout and final equipment selection.

D. Cable distribution system consisting of coaxial cables, user interfaces, directional signal taps and splitters, RF amplifiers, signal equalizers, power supplies, and required hardware complying with IEEE 802.7 and resulting in performance parameters specified in this Section. System shall be capable of distributing television channels as follows, according to EIA 542:

1. 12 VHF Channels and FM: 2 through 6 low-band VHF, FM band; and 7 through 13 high-band VHF.
2. 60 CATV Channels 2 through YY (61) low, mid, high, super, and ultra band.

E. Hardware Requirements: Use modular, plug-in, solid-state electronic components. Install amplifiers and other powered equipment on plywood backboards installed in the designated TDR locations.

1.5 PERFORMANCE REQUIREMENTS

A. Minimum acceptable distribution system performance at all user-interface points shall be as follows:

1. RF Video Carrier Level: Between 2 and 10 dBmV.
2. Relative Video Carrier Level: Within 3 dB to adjacent channel.
3. Channel Frequency Response: Across any 6-MHz channel in 54- to 220-MHz frequency range, referenced to video, signal amplitude shall be plus or minus 1 dB, maximum.
4. Carrier-to-Noise Ratio: 45 dB or more.
5. RF Visual Signal-to-Noise Ratio: 43 dB or more.
6. Cross Modulation: Less than minus 50 dB.
7. Terminal Isolation from Television to Television: 25 dB, minimum.
8. Hum Modulation: 2 percent, maximum.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for television equipment.

1. Include plans, elevations, sections, details, and attachments to other work.
2. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.
b. Minimum bending radius.
c. Maximum pulling tension.

3. Functional Block Diagram: Show single-line interconnections between components for headend and distribution system to user-interface points. Show cable types and sizes.
4. Dimensioned plan and elevations of headend equipment. Show access and workspace requirements.
5. Wiring Diagrams: Power, signal, and control wiring; and grounding.
6. Design Calculations: Calculate signal attenuation budget and show calculated line and equipment losses for the system based on the functional block diagram, to show that proposed system layout can be expected to perform up to specification. Allowable losses between components and User Interface shall be used to determine size and type of coaxial cable.

C. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add testing record of each piece of adjustable equipment, listing name of person testing, date of test, and description of as-left set points.

D. Source quality-control test reports on coaxial cable sweep tests.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For headend and distribution system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.
2. Include dimensioned plan and elevation views of components and enclosures. Show access and workspace requirements.

G. Samples: Full size, for each outlet and finish plate, for colors and textures required.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NECA 1.

C. Comply with NFPA 70.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: System components shall be equipped and rated for the environments where installed.

1.9 COORDINATION

A. Coordinate size and location of raceway system, and provisions for electrical power to equipment of this Section.

B. Coordinate Work of this Section with requirements of Owner's selected service provider.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Provide no fewer than one of each item listed below. Deliver extra materials to Owner.

1. Fuses: One for every 10; each type and rating.
2. Splitters: One for every 10 installed.
3. MATV Distribution Power Amplifiers: One for every 10; each type installed.
4. MATV Signal Traps: One for every 10; each type used.
5. MATV Attenuators: One for every 10; each type used.
6. Cable: 100 feet; each type used.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SYSTEMS REQUIREMENTS

A. Components: Modular plug-in, heavy-duty, industrial- or commercial-grade units.

B. Equipment: Silicon-based, solid-state, integrated circuit devices.

C. Power Supply Characteristics: Devices shall be within specified parameters for ac supply voltages within the range of 105 to 130 V.

D. Protect signal cables and connected components against transient-voltage surges by suppressors and absorbers designed specifically for the purpose. Comply with Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."

E. Provide ac-powered equipment with integral surge suppressors, complying with UL 1449.

F. RF and Video Impedance Matching: Signal-handling components, including connecting cable, shall have end-to-end impedance-matched signal paths. Match and balance devices used at

connections where it is impossible to avoid impedance mismatch or mismatch of balanced circuits to unbalanced circuits.

2.3 MATV EQUIPMENT

A. Description: Signal-source components and amplifying equipment, distribution components, and interconnecting wiring. System shall receive signals from sources, amplify and process them, and distribute them to outlets for receiving sets.

B. MATV System Quantitative Performance Requirements: Level and quality of signal at each outlet from each designated channel and source shall comply with Specifications below when tested according to 47 CFR 76.

2.4 MATV DISTRIBUTION COMPONENTS

A. Manufacturers:

1. Blonder Tongue Laboratories, Inc.
2. Channel Master, Inc.
3. Motorola Broadband Communications Sector.
4. Pico Macom

B. Distribution Equipment: Broadband amplifier and combining networks for receiving television signals and outputting the signals to cable distribution system.

C. Broadband Amplifier:

1. Frequency Range: 54 to 750 MHz.
2. Frequency Response: Plus or minus 1.0 dB across passband.
3. Maximum Noise: 10 dB.
4. Minimum Return Loss: 16 dB.
5. I/O Impedance: 75 ohms.

2.5 DISTRIBUTION COMPONENTS

A. Manufacturers:

1. Blonder Tongue
2. Channel Master
3. Motorola Broadband Communications Sector.
4. Pico Macom

B. Distribution components shall be for signal processing and distribution downstream from headend equipment.

C. Signal Splitters and Isolation Taps: Metal-enclosed directional couplers with brass connector parts.

1. Return Loss: 17 dB.

2. RFI Shielding: 100 dB.
3. Isolation: 25 dB.
4. Impedance: 75 ohms for input and output terminals.
5. Electrically powered components shall be UL labeled.

D. Signal Traps: Packaged filters tuned to interference frequencies encountered in Project.

E. Attenuators: Passive, of fixed value, used to balance signal levels.

F. Terminating Resistors: Enclosed units rated 0.5 W and matched for coaxial impedance.

G. User-Interface Device (TV Outlets): Flush, female-type outlets for mounting in standard outlet box, with metallic parts of anodized brass, beryllium copper, or phosphor bronze.

1. Cable Connector: Female, Type F.
2. Wall Plates: Match materials and finish of power outlets in same space.
3. Attenuation: Less than 0.1 dB.
4. Voltage Standing-Wave Ratio: Less than 1.15 to 1.

2.6 CABLES

A. Manufacturers:

1. Alpha Wire Company.
2. Belden Inc.; Electronics Division.
3. Coleman Cable.
4. CommScope Properties, LLC.
5. West Penn Wire/CDT; a division of Cable Design Technologies, Inc.

B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband MATV applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB minimum from 7 to 806 MHz, and shall be listed to comply with NFPA 70, Articles 810 and 820.

C. RG-6/U, Plenum-Rated Indoor Distribution Cable (Horizontal Drop): No. 16 AWG, solid bare copper conductor; gas-injected foam-PE insulation. Double shielded with 100 percent aluminum-foil shield, 60 percent aluminum braid. Copolymer jacket. NFPA 70, Type CATV and UL 910.

D. RG-11/U, Plenum-Rated Indoor Distribution Cable (Trunk): No. 14 AWG, solid bare copper conductor, gas-injected foam-PE insulation. Double shielded with 100 percent aluminum foil shield, 60 percent aluminum braid. Copolymer jacket. NFPA 70, Type CATV and UL 910.

2.7 CABLE CONNECTORS

A. Manufacturers:

1. Amphenol Corporation.
2. B&L Coaxial Connections, Ltd.
3. Connect-Tech Products.

4. Leviton Voice & Data Division.

B. MATV Coaxial Cable Connectors: Type F, 75 ohms.

2.8 SOURCE QUALITY CONTROL

A. Cable products shall be sweep tested at the factory before shipping at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for coaxial cable installation. Check raceways, cables, trays, and other elements for compliance with accessibility for installation and maintenance, and other conditions affecting installation.

B. Examine roughing-in for antenna to verify actual locations of cable connections before antenna installation.

C. Examine walls, floors, roofs, equipment bases, and roof supports for suitable conditions where television equipment is to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wiring Method: Install cables in raceways except in accessible indoor ceiling spaces, attics and as otherwise indicated. Conceal raceways and wiring except in unfinished spaces.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

C. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

D. Grounding: According to recommendations in IEEE 142 and IEEE 1100.

3.3 COAXIAL CABLE INSTALLATION

A. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps may not be used for heating.

B. Cable may not be installed in same raceway with power cable.

C. Coaxial cable shall not be spliced except on plywood backboards in wire closets, or in cabinets designated for the purpose.

D. Outdoor connections shall be installed in enclosures meeting NEMA 250, Type 4X. Connectors shall be corrosion resistant with properly designed O-rings to keep out moisture.

E. Do not use water-based cable pulling lubricants with PVC-jacketed cable.

F. Do not exceed manufacturer's recommended minimum bending radiuses

G. Pulling Cable: Do not exceed manufacturer's recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

H. Exposed Cable: Install parallel to building lines, follow surface contours, and support cable according to manufacturer's written instructions. Do not run adjacent and parallel to power or data cables.

I. Cable Support: Install supports at intervals recommended in writing by cable manufacturer. Install supports within 6 inches of connector so no weight of cable is carried by connector. Use no staples or wire ties, pull tie-wrap snug, and do not over tighten.

J. Signal Equalization: Where system performance may be degraded in certain operating modes, revise component connections and install distribution amplifiers and attenuators as required, providing a balanced signal across the system.

K. Install passive circuit devices, such as splitters and attenuators, in wire closets or cabinets. Do not install attenuators as part of user-interface device outlets.

3.4 EQUIPMENT INSTALLATION

A. Mount distributed equipment as recommended by manufacturer. Group related items in methodical sequence.

B. Arrange equipment to facilitate access for maintenance and to preserve headroom and passage space. Parts that require periodic service or maintenance shall be readily accessible. Headend components that require tuning adjustments shall be accessible from the front of equipment cabinets.

C. Antenna Cable Entrance (If required): Use entrance fittings, seal, and waterproof penetrations of the building envelope.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

C. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Replace malfunctioning or damaged items. Retest until satisfactory performance and conditions are achieved. Prepare television equipment for acceptance and operational testing as follows:

1. Use an agile receiver and signal strength meter or spectrum analyzer for testing.
2. CATV Sources: Connect receiver to an agile demodulator or CATV set-top converter at CATV service entrance to the facility.

D. Test Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.

E. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

F. Distribution System Acceptance Tests:

1. Field-Strength Instrument: Rated for minus 40-dBmV measuring sensitivity and a frequency range of 54 to 812 MHz, minimum. Provide documentation of recent calibration against recognized standards.
2. Signal Level and Picture Quality: Use a field-strength meter or spectrum analyzer, and a standard TV receiver to measure signal levels and check picture quality at all TV outlets.

   a. Test the signal strength in dBmV at 55 and 750 MHz.
   b. Minimum acceptable signal level is 0 dBmV (1000 mV).
   c. Maximum acceptable signal level over the entire bandwidth is 12 dBmV.
   d. Television receiver shall show no evidence of cross-channel intermodulation, ghost images, or beat interference.

G. Qualitative and Quantitative Performance Tests: Demonstrate reception quality of color-television program transmissions at each user interface from each designated channel and source. Quality shall be equal to or superior than that obtained with performance checks specified below, using a standard, commercial, cable-ready, color-television receiver. Level and quality of signal at each outlet and from each designated channel and source shall comply with the following Specifications when tested according to 47 CFR 76:

1. RF video-carrier level.
2. Relative video-carrier level.
3. Broadband frequency response.
4. Channel frequency response.
5. Carrier-to-noise ratio.
6. RF visual signal-to-noise ratio.

7. Cross modulation.
8. Terminal isolation.
9. Hum modulation.

H. Record test results.

I. Retest: Correct deficiencies identified by tests and observations and retest until requirements specified in Part 1 are met.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain MATV equipment.

1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
2. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.
3. Demonstrate programming and tuning of satellite receivers.
4. Refer to Division 01 Section "Demonstration and Training."

B. Conduct a minimum of four hours' training as specified in instructions to Owner's employees in Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 275113
Overhead Paging

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Primary Division 27 subcontractor shall be accountable for closely coordinating the Overhead Paging system with the General Contractor.
   1. Division 27 is accountable for including the cabling, equipment, and installation in its work based on the project drawings.

B. Drawings and general Contract provisions, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

C. Requirements of the following Division 26 Sections apply to this Section:
   1. Basic Electrical Requirements.
   2. Basic Electrical Materials and Methods.

1.2 SUMMARY

A. This section includes installing an overhead paging system that is accessible through the telephone system. It includes requirements for paging system components, including, but not limited to, the following:
   1. Speaker systems.
   2. Wiring

B. This section requires that the Division 26 installer provide rough-in materials for installation under Division 26. Rough-in materials include, but are not limited to, conduit, junction boxes, alternative raceway, and device enclosures. The Division 27 installer is to provide cable for this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following (for each type of product) as listed in the drawings and these specifications:
   1. BiAmp – (Vocia)

2.2 SYSTEM REQUIREMENTS

A. General: Provide complete and fully functional overhead paging systems using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction in accordance with published product information. Coordinate the features of materials and equipment to form an integrated system with components and interconnections matched for optimum performance of specified functions.

2.3 EQUIPMENT AND MATERIALS

A. General: Provide all solid-state components fully rated for continuous duty at the specified ratings. Select equipment for regular operation on input power supplied at 105-130 V, 60 Hz.

B. Loudspeakers shall be Drop-In Tile speakers, 24” x 24” tile speakers provided by one of the following manufacturers.
   1. Bogen CSD2X2/VR

2. Quam System 12/70RS

C. The transformer must be capable of providing 25V/70V.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Overhead Paging System work.

B. Do not proceed until unsatisfactory conditions have been corrected.

C. Verify compliance of the following items before beginning sound equipment installation.
1. No cables spliced except at standard barrier terminal blocks inside the equipment cabinet.
2. Cables marked at each end with permanent wire labels such as Brady or equal.
3. Isolated ground runs back to the main electrical panel from the paging equipment cabinet.
4. Specified conduit, cables, speaker enclosures, and equipment cabinets are correctly installed.

3.2 INSTALLATION

A. General: Install the system in accordance with NFPA 70 and other applicable codes. Install the equipment in accordance with the manufacturer's written instructions.

B. Speakers:
1. Confirm speaker polarity before installation and wire to maintain uniform polarity.
2. Mount transformers with screws securely to speaker brackets or enclosures.
3. Neatly mount speaker grilles, panels, connector plates, etc., tight, plumb, and square unless indicated otherwise on drawings.
4. Provide brackets, screws, adapters, springs, rack mounting kits, etc., recommended by manufacturer for correct assembly and installation of speaker assemblies and electronics components.
5. Identification:
a. Legibly identify user-operated system controls and system input/output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexon labels. Label equipment and controls within the equipment cabinet using similar labels or "Kroy" type labels.

C. Repairs: Wherever walls, ceilings, floors, or other building finishes are cut for installation, the contractor is responsible for repairing, restoring, and refinishing them to their original appearance.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide the services of a factory-authorized service representative to supervise the field assembly and connection of components and the system's pre-testing, testing, and adjustment.

B. Pre-testing: Upon completing the system's installation, align, adjust, and balance it, and perform a complete pretest. Determine the system's conformance to the requirements of the Drawings and Specifications. Correct deficiencies observed. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved.

3.4 COMMISSIONING

A. Occupancy Adjustments: When requested by the Architect or the Sound/Acoustical Consultant within one year of the date of substantial completion, provide on-site assistance in adjusting

sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide two trips for this purpose.

3.5 CLEANING AND PROTECTION

A. Before final acceptance, clean system components and protection from damage and deterioration.

END OF SECTION

SECTION 275117
NETWORKED PUBLIC ADDRESS AND PAGING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Primary Division 27 subcontractor shall be accountable to closely coordinate the Overhead Paging system with the General Contractor.
   1. Division 27 is accountable for including the cabling, equipment, and installation thereof in their work; based upon the project drawings.

B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

C. Requirements of the following Division 26 Sections apply to this Section:
   1. Basic Electrical Requirements.
   2. Basic Electrical Materials and Methods.

1.2 SUMMARY

A. This Section includes the installation of an overhead paging system that shall be accessible through the telephone system. It includes requirements for paging system components including, but not limited to, the following:
   1. Speaker systems.
   2. Wiring

B. This section requires that rough-in materials for this section be provided by the Division 26 installer for installation under Division 26. Rough-in materials include but are not limited to conduit, junction boxes, alternative raceway, and device enclosures. Cable for this section is to be provided by the Division 27 installer.

1.3 SYSTEM DESCRIPTION

A. General: The networked public address paging system shall be a complete system for delivering audio signals to distributed programmable amplifier modules via the facility's Ethernet network. Input from the telephone system to the network as the paging system source will need to be coordinated to provide a SIP trunk connection.

B. Functional Performance: Components and system features and functions shall include, but are not limited to, the following:
   1. Meet the following performance parameters as measured in 1/3 octave bands:
      a. From 100 Hz to 2kHz, flat within plus or minus 2dB.
      b. Above 2kHz, slope down along an approximate 3dB octave slope to 8kHz.
   2. When driven to maximum output, clipping shall first occur in power amplifiers.
   3. No noise, hum, RFI pickup or distortion shall be audible under normal operating conditions.
   4. The overhead paging system shall reproduce program material at a level of 85 dBA without audible distortion.

1.4 ACTION SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections

B. Product data for system components, including "Nationally Recognized Testing Laboratory" (NRTL) listing data and list of materials, dimensioned plans, sections, and elevations showing minimum clearances, mounting arrangements, and installed features and devices.

C. Wiring Diagrams and Speaker loads: Provide the following for each speaker type used, amp loads, zoning with total loads.
   1. Wiring diagrams for scheduled items requiring power. Identify manufacturer-installed and field-installed wiring.
   2. Provide load calculations and requirements for each Zone with number of device. Size the conductors for each zone appropriately to maintain this requirement.
   3. Provide cable type (as indicated on the Shop Drawings Wire Legend) that is used for zone, the conductor size, the estimated total length of cable, the estimated line loss (voltage drop), and the percentage of estimated line loss (voltage drop).

D. System operation description, including method of operation of each component and each type of circuit, and sequence of operations for all manually and automatically initiated system inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are not acceptable.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data for inclusion in "Operating and Maintenance Manual" specified in Division 01. Include data for each type product, including all features and operating sequences, both automatic and manual. Include user's software data and recommendations for spare parts to be stocked at the site. Provide names, addresses, and telephone numbers of service organizations that stock repair parts for the system.

B. Product certifications signed by the manufacturers of system components certifying that their products comply with the referenced standards.

C. Separate Qualification Data for Manufacturers and Installers: Demonstrate their capabilities and experience as specified in Quality Assurance Article. Include lists of completed projects with project names and addresses, names of Contracting Officer and Government representatives, plus other information specified.

D. Record of field tests of system.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Provide no fewer than one of each item listed below. Deliver extra materials to Owner.

   1. Speaker: One for every 30; each type and rating.

2. Distribution Power Amplifiers: One for every 10; each type installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who is a factory authorized sales and service representative of those manufacturers specified to perform the work of this Section. Refer to Division 1 Section "Definitions and Standards" for definition of experienced Installer. Upon request, submit evidence of such qualifications to the specifying authority.

B. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code."

C. EIA Compliance: Comply with the following Electronics Industries Association Standards:
1. Sound Systems, EIA 160.2.
2. Loudspeaker, Dynamic Magnetic Structures, and Impedance, EIA 299 A.
3. Racks, Panels, and Associated Equipment, EIA 310 A.
4. Amplifiers for Sound Equipment, SE 101 A.
5. Speakers for Sound Equipment, SE 103.
6. Microphones for Sound Equipment, SE 105.
7. UL Compliance: Comply with requirements of UL 50.

D. Coordination of Work: Coordinate the Work of this Section with the requirements of the Owner's paging system technicians and perform the following:
1. Pre-Installation Meeting: Meet jointly with the representatives of the Owner, to exchange information and agree on details of installation interfaces, current system operations including zone identification and classification, and any other circumstances that impact on the completion of the work of this Section.
2. Record agreements reached in the meeting and distribute the record to the other participants.

1.8 WARRANTY

A. In addition to the requirements of Division 1 and other sections of this specification, provide complete warranty repair or replacement for a minimum of one year after date of substantial completion at no cost to owner, except in the case of obvious abuse

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement of rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty.

D. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

E. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding

defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

F. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
   1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

G. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

H. Special Warranty: Manufacturer agrees to repair or replace paging system equipment and components that fail because of defects in materials or workmanship within specified warranty period.

   Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (for each type of product) as listed in the drawings and these specifications:
   1. BiAmp Vocia
   2. Atlas Sound (Speaker only)
   3. Bogen (Speaker Only)
   4. Quam (Speaker Only)

2.2 SYSTEM REQUIREMENTS

A. General: Provide complete and fully functional overhead paging systems using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction in accordance with published product information. Coordinate the features of materials and equipment so they form an integrated system with components and interconnections matched for optimum performance of specified functions.

2.3 EQUIPMENT AND MATERIALS

A. General: Provide all solid-state components fully rated for continuous duty at the ratings indicated or specified. Select equipment for normal operation on input power supplied at 105-130 V, 60 Hz.

B. Loudspeakers shall be Drop-In Tile speakers. To be 24” x 24” tile speakers, provided by one of the following manufactures.

1. Bogen CSD2X2/VR
2. Quam System 12/70RS

C. Transformers must be capable of providing 25V/70V.

D. RACK ENCLOSURES: All rack-mount Paging System (PS) equipment shall be housed in EIA standard 19” equipment enclosures. Given the distributed networked nature of the system, it may be necessary to locate such rack enclosures at multiple sites throughout the facility, where each site is secure from the public. Each rack may be wall-mounted or floor-mounted, as required by specific instructions, or by the space(s) available.
   1. Adequate ventilation shall be supplied for each rack, and temperatures at all critical components shall not exceed 95 degrees F. Convection or forced air cooling may be used, as long as this heat threshold is not surpassed, regardless of external factors. System components featuring internal forced-air cooling shall be provided adequate hot air extraction through the rear of the enclosure.
   2. Each rack shall be constructed of 16-gauge steel with 14-gauge steel mounting rails. All joints shall be welded and bonded.
   3. Rear access to each rack shall be lockable.
   4. The height of each rack shall be as required for the specified equipment, plus 25% spare space for future growth.
   5. Blank panels shall be provided to fill all unused rack space.
   6. Acceptable rack manufacturers:
      a. Middle Atlantic
      b. Atlas Sound

E. NETWORK: The Paging System (PS) shall be based on IEEE 802.3.af PoE Ethernet Network Infrastructure. All cabling, conventions and equipment shall be consistent with this IEEE standard.
   1. SWITCHES shall be managed-type, with VLAN capabilities and Power-OverEthernet (PoE) for all devices except AMPLIFIERS and SERVERS. Care should be taken to ensure that each Switch be able to supply adequate PoE power to the endpoint devices it serves. Uplink ports for each switch shall be via Optical Fiber. Either Multimode or Single-mode fiber may be used, as determined by the length of the required uplink runs. Each port on each Switch shall be capable of sustained 100MBit data rates.
   2. SWITCHES for life safety compliant system components (Amplifiers, Life Safety Interface, Emergency Paging Station) shall be rugged industrial types with dry contact output for switch failure.
   3. SPANNING TREE single-point failure-resistant network topology shall be used, if the system is required to be life-safety capable or withstand failure of a network sector.
   4. UPS (uninterruptable power supply) systems shall be provided for all lifesafety critical network components. UPS units shall have the capacity to power the units they serve for a minimum of 90 minutes from removal of mains power. UPS units shall monitor their proper functioning, and provide alerts via Form-C contact closures upon mains or any other failure.
   5. One consistent VLAN (Virtual Local Area Network) shall be established across each managed Switch, with enough ports to accommodate the PS devices attached to it, plus 25% for future expansion. A second VLAN may be required to handle additional VoIP traffic to/from certain devices, and a third VLAN may be required for third-party control, and communication to other PS systems.

F. COMPUTER (CPU): A CPU may be present as part of the PS but is not required for PS to function. It is recommended that the CPU and its monitor be rack-mounted, but rack mounting is not a requirement. The CPU and its accessories shall meet the following minimum specifications:
   1. Microsoft Windows 10, Windows 11.
   2. Intel Pentium Dual Core processor, 2.6 GHz.
   3. 16 GB RAM.
   4. 1 TB SATA hard drive.
   5. Integrated video adapter, minimum 1280x1024 native output at 32-bit color.
   6. Integrated gigabit Ethernet port.
   7. User Interface shall be a single rack-space combined 17” LCD monitor, keyboard and track-pad mouse. Monitor shall be active-matrix color type, capable of native 1280x1024 resolution.

2.4 PAGING SYSTEM (PS):

A. The PS shall be distributed in structure, such that there is no “head end” control location, and thus has no central point of failure.

B. The PS shall use the VLAN for transport of all digital audio data, including all recorded and live voice messages, preambles, background music and other audible signals, routine or emergency. This same Network shall carry monitoring and control data to and from each PS device. This audio data traffic shall be standard CobraNet at a sample rate of 48 kHz and latency of 5.33ms. For particulars, please access www.cobranet.info.

C. All PS components shall be continuously monitored for presence, proper function and faults. Each and every fault must be logged internally to the unit, and be able to viewed and copied to an attached Monitoring Computer, running software supplied by the Manufacturer.

D. All PS components shall be addressable on the CobraNet VLAN by means of dual 4- bit rotary ID switches.

E. All PS preambles, voice prompts and recorded announcements shall be in 16-bit monaural WAV file format. The Paging System shall be capable of importing custom preambles, prompts and announcements using an AUDIO FILE MANAGER function, through the Manufacturer Software running on an attached computer.

F. Each PS device shall have sufficient on-board memory to retain its configuration and settings in the event of power loss.

G. All PS components shall be CE marked, UL listed and shall comply with the RoHS directive.

H. CARD FRAME AMPLIFIER: CFPS amplifier shall be located throughout the facility, as available space and efficiencies dictate. Each CFPS amplifier shall meet the following specifications:
   1. Power scalable in software from 100 Watts to 600 Watts per output channel, in 100 Watt increments.
   2. Up to 2400 Watts output power capability from each amplifier chassis.
   3. Each channel provides selected power into low impedance load, 70V line or 100V line, without the need for external transformer.
   4. Front panel indications for Signal Present, Card Failure, Signal Clip, OverTemperature, Fan Fault.
   5. Up to eight (8) amplifier modules per amplifier chassis.
   6. Complete DSP (digital signal processing) per output channel, including page ducking, 5-band parametric filters, compressor/limiter, 8-band speaker equalization, and delay adjustable up to 2700 milliseconds.
   7. Programmable channel-to-channel fail-over capability or chassis-to-chassis failover capability.

8. With additional failover module installed 2 x 3:1 or 7:1 failover shall be possible within the amplifier chassis.
9. Fail-over Link connector, for chassis-to-chassis fail-over logic.
10. Ability to support end-of-line monitoring devices (ELDs). Each amplifier output module shall support up to 15 ELDs.
11. Ability to support Ambient Noise Compensation (ANC) circuitry, to allow for consistent Background Music (BGM) and routine page levels per amplifier channel or group of channels.
12. Primary and Secondary CobraNet data ports wired to the CobraNet VLAN.
13. Ability to store emergency messages in on-board non-volatile digital memory.
14. Ability to report and log all detected faults internal to each amplifier module and any ANC or ELD device attached to it.
15. Design Make/Model: Biamp Vocia VA-8600 or VA-8600c, with AM-600 or AM-600c amplifier modules.

I. SMALL AMPLIFIERS: PS amplifiers shall be located throughout the facility, as available space and efficiencies dictate. Each PS small amplifier shall meet the following specifications:
1. Power variants are 2 x 60 Watts or 4 x 30 Watts per amplifier chassis
2. Up to 120 Watts output power capability from each amplifier chassis.
3. Each channel provides selected power into low impedance load, 70V line or 100V line, without the need for external transformer.
4. Front panel indications for Signal Present, Card Failure, Signal Clip, OverTemperature, Fan Fault.
5. If local line level input or dual power input is required then the ‘e’ version of amplifiers shall be used.
6. Complete DSP (digital signal processing) per output channel, including page ducking, 5-band parametric filters, compressor/limiter, 8-band speaker equalization, and delay adjustable up to 500 milliseconds.
7. Programmable channel-to-channel fail-over capability or chassis-to-chassis failover capability. 3:1 failover shall be possible in the four channel amplifier variants.
8. Fail-over Link connector, for chassis-to-chassis fail-over logic.
9. Ability to support end-of-line monitoring devices (ELDs). Each amplifier output module shall support up to 15 ELDs.
10. Ability to support Ambient Noise Compensation (ANC) circuitry, to allow for consistent Background Music (BGM) and routine page levels per amplifier channel or group of channels.
11. Primary and Secondary CobraNet data ports wired to the CobraNet VLAN.
12. Ability to store emergency messages in on-board non-volatile digital memory.
13. Ability to report and log all detected faults internal to each amplifier module and any ANC or ELD device attached to it.
14. Design Make/Model: Biamp Vocia VA-2060/VA-2060e or Biamp Vocia VA4030/VA-4030e.

J. MIDSIZE AMPLIFIERS: MPS amplifiers shall be located throughout the facility, as available space and efficiencies dictate. Each MPS amplifier shall meet the following specifications:
1. Power variants are 8 x 150 Watts or 4 x 300 Watts per amplifier chassis.
2. Up to 1200 Watts output power capability from each amplifier chassis.
3. Each channel provides rated power into 70V or 100V line without the need for external transformer.

4. Front panel indications for Signal Present, Card Failure, Signal Clip, OverTemperature, Fan Fault.
5. Complete DSP (digital signal processing) per output channel, including page ducking, 5-band parametric filters, compressor/limiter, 8-band speaker equalization, and delay adjustable up to 32 seconds.
6. Programmable channel-to-channel fail-over capability or chassis-to-chassis failover capability. 3:1 failover shall be possible in the four channel amplifier variants.
7. Fail-over Link connector, for chassis-to-chassis fail-over logic.
8. Ability to support end-of-line monitoring devices (ELDs). Each amplifier output module shall support up to 15 ELDs.
9. Ability to support passive end of line monitoring devices (PLDs). Each amplifier shall support a combination of PLD or ELD on different channels if required.
10. Ability to support Ambient Noise Compensation (ANC) circuitry, to allow for consistent Background Music (BGM) and routine page levels per amplifier channel or group of channels.
11. Primary and Secondary CobraNet data ports wired to the CobraNet VLAN.
12. Ability to store emergency messages in on-board non-volatile digital memory.
13. Ability to report and log all detected faults internal to each amplifier module and any ANC or ELD device attached to it.
14. Design Make/Model: Biamp Vocia VA-8150CV or Biamp Vocia VA-4300CV.

K. END-OF-LINE DEVICE (ELD):
1. Each ELD shall be Power over Ethernet (PoE), Class-3, and wired to the CobraNet VLAN.
2. Each ELD shall be housed in a small, surface-mountable enclosure.
3. Each ELD shall be compatible with low impedance and constant voltage systems.
4. Each ELD shall respond to a digital integrity signal sent down the speaker line from the amplifier channel module. Once the channel module to ELD link is established, the absence of a response from an associated ELD shall result in a Speaker Line Fault.
5. Each ELD shall monitor its attached speaker line, and report faults to its associated amplifier.
6. Faults monitored by the ELD shall include short circuit, open circuit and ground fault as per EN54-16 requirements.
7. Design Make/Model: Biamp Vocia ELD-1.

L. PASSIVE END OF LINE DEVICES (PLD):
1. Each PLD shall be installed on the end of the speaker line and will not require any additional cabling.
2. Each PLD shall be housed in a small, surface-mountable enclosure.
3. Each PLD shall be compatible with 70v or 100v constant voltage systems.
4. Each PLD shall respond to a pilot tone integrity signal sent down the speaker line from the amplifier channel module. Once commissioned, the absence of a PLD shall result in a Speaker Line Fault.
5. Each PLD shall monitor its attached speaker line, and report faults to its associated amplifier.
6. Faults monitored by the PLD shall include short circuit, open circuit and ground fault as per EN54-16 requirements.
7. Design Make/Model: Biamp Vocia PLD-1 or Biamp Vocia PLD-2.

M. M. AMBIENT NOISE COMPENSATORS (ANC):

1. 1. Each ANC shall be Power over Ethernet (PoE), Class-3, and wired to the CobraNet VLAN.
2. 2. Each ANC shall be housed in a small, surface-mountable enclosure.
3. 3. Each ANC shall respond to its associated amplifier channel module(s), advising that channel module(s) of a substantial change in ambient noise level.
4. 4. Each ANC shall have two microphone inputs, each with 48V phantom power.
5. 5. Each ANC shall offer software-adjustable microphone gain and phantom power controls.
6. 6. If two microphones are attached to an ANC, the ambient level reported to the associated amplifier channel(s) shall be the sum of the two microphones.
7. 7. Each ANC shall use an adaptive algorithm to incorporate the use of a reference, in order to accurately distinguish ambient noise from PS generated announcements and background music. Gap sensing ANC technology shall not be employed.
8. 8. Design Make/Model: Biamp Vocia ANC-1.

N. AMBIENT NOISE SENSING MICROPHONE (AMIC): AMICs shall be located in the ceiling of a zone, away from individual speakers and persons paging. These microphones are to be uninhibited by other ceiling systems.
1. 1. Each AMIC shall have a pickup pattern best suited for the specific application.
2. 2. Each AMIC shall be Self-Polarized Condenser type, phantom-powered from its ANC.
3. 3. Each AMIC shall be mountable to ceiling tiles and panels of at least one inch thickness, or into a deep single-gang electrical box.
4. 4. Design Make/Model:

O. O. RACK-MOUNTED INPUT DEVICE (RMID): Devices of this type serve to allow input from low-priority analog sources, such as Background Music (BGM) sources and local entertainment systems. Each RMID shall meet the following minimum specifications:
1. Powered over Ethernet (PoE), Class-3, and wired to the CobraNet VLAN.
2. The ability to output a Multicast Bundle of 6 monaural signals to the CobraNet VLAN.
3. Four pairs of unbalanced RCA jacks plus four balanced inputs. Each RCA jack pair shall mix to a single signal prior to digitization for stereo to mono summing.
4. Two balanced Mic/Line inputs with phantom power, to accommodate other sources.
5. Adjustment of input gain and phantom power via software.
6. Complete DSP (digital signal processing) per input channel, including 5- band parametric filters and compressor/limiter.
7. Four Control Inputs, each with variable trigger thresholds and operation modes: high/low/toggle high/toggle low.
8. Four Form-C contact outputs with variable operation modes: high/low/pulse high/pulse low.
9. Ability to report and log any and all failure conditions associated with its operation.
10. Design Make/Model: Biamp Vocia VI-6.

P. ENHANCED RACK-MOUNTED INPUT DEVICE (ERMID): Devices of this type serve to allow input from third party analog or CobraNet sources, such as other paging/audio systems. In emergency systems it can act as a slave device to the LSI and be connected to building safety systems such as the Fire Alarm System (FAS) or Building Management System (BMS). It can also operate as a standalone device for non-emergency purposes. Each ERMID shall meet the following minimum specifications:

1. Primary and secondary power for ERMID shall be from approved 24VDC external power source.
2. Primary and Secondary CobraNet data ports wired to the CobraNet VLAN.
3. The ability to output a Multicast Bundle of 8 monaural signals to the CobraNet VLAN.
4. Eight balanced Mic/Line audio inputs with phantom power. Each balanced input shall mix to a single signal prior to digitization for stereo to mono summing.
5. Each balanced MIC/Line audio input shall be able to be automatically triggered when audio is sent to it (VOX).
6. Adjustment of input gain and phantom power via software.
7. Complete DSP (digital signal processing) per input channel, including 5- band parametric filters and compressor/limiter.
8. Eight Control Inputs, each with variable trigger thresholds and operation modes: high/low/toggle high/toggle low.
9. Eight Form-C contact outputs with variable operation modes: high/low/pulse high/pulse low.
10. Ability to report and log any and all failure conditions associated with its operation.
11. Design Make/Model: Biamp Vocia VI-8.

Q. RACK-MOUNTED OUTPUT DEVICE (RMOD): Devices of this type serve as zone outputs to non-monitored sub-systems such as legacy amplifiers, audio recording devices or local entertainment systems. Each RMOD shall meet the following minimum specifications:
1. Power over Ethernet (PoE), Class-3, and wired to the CobraNet VLAN.
2. Four balanced analog audio outputs, selectable in software for +4/0/-10 dBu output levels.
3. Complete DSP (digital signal processing) per output channel, including page ducking, 5-band parametric filters, compressor/limiter, crossover, 8-band speaker equalization, and delay adjustable up to 500 milliseconds.
4. Four Control Inputs, each with variable trigger thresholds and operation modes: high/low/toggle high/toggle low.
5. Four Form-C contact outputs with variable operation modes: high/low/pulse high/pulse low.
6. Ability to report and log any and all failure conditions associated with its operation.
7. Each PSD10 will provide four auxiliary ports that can be used to input audio, relay input for triggering page codes and support for auxiliary microphones (AM) and Paging Station Interfaces (PSI).
8. Design Make/Model: Biamp Vocia VO-4.

R. ENHANCED RACK-MOUNTED OUTPUT DEVICE (ERMOD): Devices of this type serve as zone outputs to monitored sub-systems such as legacy amplifiers, audio recording devices, active loudspeakers or local entertainment systems that require provision for emergency messages and redundancy. Each ERMOD shall meet the following minimum specifications:
1. Power over Ethernet (PoE), Class-3, and wired to the CobraNet VLAN.
2. Four balanced analog audio outputs, selectable in software for +4/0/-10 dBu output levels.
3. Complete DSP (digital signal processing) per output channel, including page ducking, 5-band parametric filters, compressor/limiter, crossover, 8-band speaker equalization, and delay adjustable up to 2700 milliseconds.

4. Programmable channel-to-channel fail-over capability or chassis-to-chassis failover capability.
5. Four Control Inputs, each with variable trigger thresholds and operation modes: high/low/toggle high/toggle low.
6. Provision for dual 24 VDC power input.
7. Primary and Secondary CobraNet data ports wired to the CobraNet VLAN.
8. Four Form-C contact outputs with variable operation modes: high/low/pulse high/pulse low.
9. Ability to report and log any and all failure conditions associated with its operation.
10. Ability to store emergency messages in on-board non-volatile digital memory.
11. Ability to support Ambient Noise Compensation (ANC) circuitry, to allow for consistent Background Music (BGM) and routine page levels per amplifier channel or group of channels.
12. Ability to support end-of-line monitoring devices (ELDs). Each ERMOD output module shall support up to 15 ELDs.
13. Primary and Secondary CobraNet data ports wired to the CobraNet VLAN.
14. Design Make/Model: Biamp Vocia VO-4e.

S. PAGING STATION, DESK-TYPE 4-BUTTON (PSD4):
1. Each PSD4 shall be Power over Ethernet (PoE), Class-3, and wired to the CobraNet VLAN.
2. Each PSD4 shall have four buttons, each assignable to a specific paging task, plus a large round push-to-talk button and LEDs to indicate “wait” and “talk now.”
3. Each PSD4 shall be equipped with a high quality dynamic cardioid (unidirectional) element, with integral secondary element for signal path testing, mounted on a flexible gooseneck.
4. Each PSD4 shall have integral DSP functions: 5-band parametric filters and compressor/limiter.
5. Each PSD4 shall have internal memory, sufficient to store delayed pages of up to 120 seconds duration, as well as four preamble WAV files.
6. Each PSD4 shall have a backlit LCD display, indicating page code (program) selected, availability of destination zones and security code entry, as well as other optional information.
7. Each PSD4 shall be capable of storing a live page message, when some destination zones are busy. The PSD4 shall release the message when all destination zones become available.
8. Each PSD4 shall have the ability to report and log any and all failure conditions associated with its operation.
9. Each PSD4 shall have the ability to be used for infinite live paging.
10. Each PSD4 shall have the ability to store a message from the microphone input and give the end user the ability to replay the message with an adjustable repetition count and/or repetition length.
11. Design Make/Model: Biamp Vocia DS-4.

T. PAGING STATION, DESK-TYPE 10-BUTTON (PSD10):
1. Each PSD10 shall be Power over Ethernet (PoE), Class-3, and wired to the CobraNet VLAN.
2. Each PSD10 shall have ten buttons (0 through 9, telephone-style), for the purposes of entering three-digit page codes and security codes. PSD10 shall also include a large round push-to-talk button and LEDs to indicate “wait” and “talk now.”

3. Each PSD10 shall be equipped with a high quality dynamic cardioid (unidirectional) element, with integral secondary element for signal path testing, mounted on a flexible gooseneck.
4. Each PSD10 shall have integral DSP functions: 5-band parametric filters and compressor/limiter.
5. Each PSD10 shall have internal memory, sufficient to store delayed pages of up to 120 seconds duration, as well as four preamble WAV files.
6. Each PSD10 shall have a backlit LCD display, indicating page code (program) selected, availability of destination zones and security code entry, as well as other optional information.
7. Each PSD10 shall be capable of storing a live page message, when some destination zones are busy. The PSD10 shall release the message when all destination zones become available.
8. Each PSD10 shall have the ability to report and log any and all failure conditions associated with its operation.
9. Each PSD10 shall have the ability to be used for infinite live paging.
10. Each PSD10 shall have the ability to store a message from the microphone input and give the end user the ability to replay the message with an adjustable repetition count and/or repetition length.
11. Each PSD10 will provide an auxiliary port that can be used to input audio, control data (RS-232), relay input for triggering page codes and support for auxiliary microphones (AM) and Paging Station Interfaces (PSI).
12. Design Make/Model: Biamp Vocia DS-10.

U. PAGING STATION, WALL-TYPE 4-BUTTON (PSW4):
1. Each PSW4 shall be Power over Ethernet (PoE), Class-3, and wired to the CobraNet VLAN.
2. Each PSW4 shall have four buttons, each assignable to a specific paging task, plus LEDs to indicate “wait” and “talk now.”
3. Each PSW4 shall be equipped with a dynamic noise-canceling close-talking microphone with push-to-talk button, on a 4.5-foot heavy-duty coil cord, and with an integral secondary element for signal path testing.
4. The coil cord of each PSW4 shall be strain-relieved to its metal base structure, and shall be easily replaced with simple hand tools.
5. Each PSW4 shall have integral DSP functions: 5-band parametric filters and compressor/limiter.
6. Each PSW4 shall have internal memory, sufficient to store delayed pages of up to 120 seconds duration, as well as four preamble WAV files.
7. Each PSW4 shall have a backlit LCD display, indicating page code (program) selected, availability of destination zones and security code entry, as well as other optional information.
8. Each PSW4 shall be capable of storing a live page message, when some destination zones are busy. The PSW4 shall release the message when all destination zones become available.
9. Each PSW4 shall have the ability to report and log any and all failure conditions associated with its operation.
10. Each PSW4 shall have the ability to have the hand-held microphone replaced at the project site.
11. Each PSW4 shall have the ability to be used for infinite live paging.
12. Each PSW4 shall have the ability to store a message from the microphone input and give the end user the ability to replay the message with an adjustable repetition count and/or repetition length.

13. Each PSW10 shall have the ability to be used as an Emergency Wall Station Type 4 button (EPSW10) purely by designating it as such in the manufacturers software application.
14. Design Make/Model: Biamp Vocia WS-4.

V. PAGING STATION, WALL-TYPE 10-BUTTON (PSW10):
1. Each PSW10 shall be Power over Ethernet (PoE), Class-3, and wired to the CobraNet VLAN.
2. Each PSW10 shall have ten buttons (0 through 9, telephone-style), for the purposes of entering three-digit page codes and security codes plus LEDs to indicate “wait” and “talk now.”
3. Each PSW10 shall be equipped with a dynamic noise-canceling close-talking microphone with push-to-talk button, on a 4.5-foot heavy-duty coil cord and with an integral secondary element for signal path testing.
4. The coil cord of each PSW10 shall be strain-relieved to its metal base structure, and shall be easily replaced with simple hand tools.
5. Each PSW10 shall have integral DSP functions: 5-band parametric filters and compressor/limiter.
6. Each PSW10 shall have internal memory, sufficient to store delayed pages of up to 120 seconds duration, as well as four preamble WAV files.
7. Each PSW10 shall have a backlit LCD display, indicating page code (program) selected, availability of destination zones and security code entry, as well as other optional information.
8. Each PSW10 shall be capable of storing a live page message, when some destination zones are busy. The PSW10 shall release the message when all destination zones become available.
9. Each PSW10 shall have the ability to report and log any and all failure conditions associated with its operation.
10. Each PSW10 shall have the ability to have the hand-held microphone replaced at the project site.
11. Each PSW10 shall have the ability to be used for infinite live paging.
12. Each PSW10 shall have the ability to store a message from the microphone input and give the end user the ability to replay the message with an adjustable repetition count and/or repetition length.
13. Each PSW10 shall have the ability to be used as an Emergency Wall Station Type 10 button (EPSW10) purely by designating it as such in the manufacturers software application.
14. Design Make/Model: Biamp Vocia WS-10.

W. PAGING STATION INTERFACE MODULE (PSIM): In the event that the client requires a third-party paging solution to be created then the PSIM shall be used to interface that solution into the PS.
1. The PSIM shall be connected to a paging station via RS-232, balanced analog audio and a relay to allow Push To Talk functionality.
2. It shall be powered via the paging station or RMID over Cat5, Cat5e, Cat6 or Cat7 cabling.
3. The PSIM shall support user adjustable audio input sensitivity.
4. It shall have an LED to indicate powered status.
5. It shall be CE marked, UL listed and comply with the RoHS directive.
6. Design Make/Model: Biamp Vocia VPSI-1.

X. AUXILIARY STATION, WALL-TYPE 1-BUTTON (AS1): In applications such as airports or in an industrial environment a simplified version of the paging station is required for

areas such as jetways or shop floors. For this purpose a single button wall mount microphone that connects to either a paging station or a Rack Mounted Input Device shall be used.

1. Each AS1 shall be wired using standard CAT5, CAT5e or CAT6 cabling and connected to a paging station or Rack Mounted Input Device.
2. The AS1 is not an Ethernet device and therefore should not be connected to a network switch.
3. The zone routing, priority level and type of message will be determined in the manufacturers software and is fixed so that by simply pushing the PTT button the required page code shall be called.
4. Each AS1 shall be equipped with a dynamic noise-canceling close-talking microphone with push-to-talk button, on a 4.5-foot heavy-duty coil cord and with an integral secondary element for signal path testing.
5. The coil cord of each AS1 shall be strain-relieved to its metal base structure, and shall be easily replaced with simple hand tools.
6. The DSP functions for the AS1 shall be found in the supporting device (either paging station or RMID).
7. Each AS1 will have two LEDs that indicate wait, talk now and paging unavailable states.
8. The AS1 is fully monitored by the device it is connected to (either paging station or RMID).
9. Each AS1 shall have the ability to have the hand-held microphone replaced at the project site.
10. Each AS1 shall have the ability to be used for infinite live paging.
11. Design Make/Model: Biamp Vocia VAM-1.

Y. MESSAGE SERVER (MS): The Message Server is a device that supports advanced paging functionality such as prerecorded message storage, scheduled events, third party control interfacing, storage of logged system data, auto configuration of replacement devices, inter PS paging & control, time server support and VoIP telephone paging.

1. Each MS shall be a single rack space Linux server, powered by 120-240VAC Mains.
2. Each MS shall be wired to the CobraNet VLAN and the Control Network VLAN. If Telephone Paging is enabled, then it shall be wired to the VoIP VLAN as well if required by the VoIP PABX.
3. Each MS shall have a hard drive with minimum capacity of 80 GB, for storage and playback of recorded announcements and preambles.
4. Each MS shall act as a Configuration Server for the entire PS, and have the ability to automatically program replacement devices, as needed.
5. Each MS shall include a VoIP Trunk Server, and support SIP (Session Initiation Protocol) calling, for purposes of telephone-based paging.
6. Callers using VoIP into the MS shall be given options relating to entering of security codes, the voice prompts provided and whether an extension will be directly linked to a three-digit page code. The voice prompts and extension numbers shall be programmable.
7. Each MS shall have an integral scheduler, for purposes of scheduling automated events throughout the PS system.
8. Each MS shall store log data from all system components, and be able to download that data to attached computer(s).
9. Third party control of the MS shall be possible via Ethernet or RS-232.
10. Multiple MS (up to 10) can be used in the same local paging system for redundancy and load sharing purposes. MS can be placed in separate locations to even larger paging systems in other physical locations.

11. Each MS shall be capable of supporting a complementary text to speech server (TTS).
12. Design Make/Model: Biamp Vocia MS-1e.

Z. WALL REMOTE (WR):
1. Each WR shall be Powered over Ethernet (PoE), Class-1, and wired to the CobraNet VLAN.
2. 2. Each WR shall include a back-lit multifunction LCD display and four buttons for user control, and mount over a standard 2-gang North American electrical box.
3. 3. Each WR shall allow level control over the BGM for the zone to which it is assigned.
4. 4. Each WR shall allow selection of BGM sources, among those programmed to be available for the WR's assigned zone.
5. 5. Each WR shall allow muting of low, medium and high-priority pages, if this feature is enabled from the Manufacturer Software. Urgent priority and emergency level pages will not be affected.
6. 6. Design Make/Model: Biamp Vocia WR-1.

AA. AA. LIFE SAFETY INTERFACE (LSI): This unit acts as the interface to building safety systems such as the Fire Alarm System (FAS) or Building Management System (BMS), and adds the functions required to have the PS participate in a Life-Safety system.
1. 1. Primary and secondary power for LSI shall be from approved 24VDC external power source.
2. 2. Tertiary power for LSI shall be via Power over Ethernet (PoE) switch, Class3, wired to the CobraNet VLAN.
3. 3. Further backup power can be sourced for the LSI via PoE switch, Class-3, via the secondary CobraNet port.
4. 4. LSI shall include front-panel LED indications for: Primary Power Present, System Fault, General Alarm, General Fault, Power Supply Fault, Protection Fault, Path Fault, Aux Power Present, Zone Alarms 1 through 8, Zone Faults 1 through 8.
5. 5. LSI shall have control of four emergency zones. Optional module can be fitted to increase this to 20 emergency zones, and for further increases the GPIO device can be used to support emergency zones as a slave device to the LSI.
6. 6. In EN54-16 and other certified systems the LSI shall be used in junction with the Control Interface (CI) as listed under x. of this specification.
7. 7. The LSI is responsible for monitoring all emergency devices within the Paging System and reporting faults and alarms to the FAS and/or BMS.
8. 8. The LSI is responsible for receiving and acting upon alarm triggers that are sent to it from the FAS.
9. 9. Design Make/Model: Biamp Vocia LSI-16 or Biamp Vocia LSI-16e.

BB. BB. CONTROL INTERFACE (CI): This unit acts as an interface to building safety systems such as the FAS and/or BMS, and adds the functions required to have the PS participate in a Life-Safety system under EN54-16 and other life safety standards.
1. 1. Primary power for CI shall be from approved 24VDC external power source.
2. 2. Secondary power for CI shall be via an approved 24VDC power source.
3. 3. LSI shall include front-panel push buttons that control the functions 'Local Silence', 'System Test' and 'System Fault Reset'.
4. 4. The CI shall be fitted with an internal local sounder which commences whenever any Alarm input receives an external signal from the fire detection equipment or control and indicating equipment (CIE) or equivalent. It will also commence when any Fault is detected.
5. 5. The CI shall connect directly to the LSI as well as the FAS and/or the BMS and provide the LSI with power and alarm signal.

6. 6. Design Make/Model: Biamp Vocia CI-1.

CC. GENERAL PURPOSE INPUT OUTPUT DEVICE (GPIOD): This unit has a dual purpose within the PS. It can be used to receive and output contact closures for both regular and emergency functions in the PS. In emergency systems it can act as a slave device to the LSI and be connected to building safety systems such as the Fire Alarm System (FAS) or Building Management System (BMS). It can also operate as a standalone device for non-emergency purposes.

1. Primary and secondary power for GPIOD shall be from approved 24VDC external power source when used as an emergency device.
2. Power and data communications for the GPIOD shall also be able to be sourced via Power over Ethernet (PoE) switch, Class-3, wired to the CobraNet VLAN.
3. Further backup power and data communications can be sourced for the GPIOD via PoE switch, Class-3, via the secondary CobraNet port.
4. The GPIOD shall contain 16 inputs and 16 outputs for a total of 32 possible connections.
5. The GPIOD shall be able to support general functions, emergency functions or any combination of the two within the same chassis and configuration file.
6. General functions such as prerecorded message triggering and scheduler triggering require an MS device as noted under u. of this specification.
7. When used as an emergency device the GPIOD must be used in conjunction with the Life Safety Interface enhanced version (LSIe variant) as listed under w. of this specification.
8. The LSIe is responsible for monitoring all emergency devices including any attached GPIOD within the Paging System and reporting faults and alarms to the FAS and/or BMS.
9. The LSIe is responsible for receiving and acting upon alarm triggers that are sent to it from the GPIOD.
10. Design Make/Model: Biamp Vocia GPIO-1.

DD. TEXT TO SPEECH SERVER (TTS): The system shall be able to interface to an optional Text-to-Speech Server with available language packages, for proper enunciation of messages entered as text by the PS System Operator or applicable third party control systems. This device can also be used for interfacing with third party nurse call systems to automate code calling.

1. The TTS shall be on an industrial style 1RU server powered by 120/240 volt mains.
2. Each TTS shall be wired to the CobraNet VLAN and the Control Network VLAN.
3. The TTS is supported by the MS so this must be present and accessible on both the CobraNet and Control Network VLAN's.
4. The TTS shall support at least 65 different voice fonts.
5. Each voice font will contain a language, accent and gender that are specific to the voice font.
6. Voice fonts will be licensed and provision shall be made to ascertain the client's requirements for languages.
7. If nurse call functionality is required then the nurse call version of the TTS must be ordered.
8. The nurse call version will support the standard TAP language for control communications with the third-party nurse call system.
9. The nurse call version will allow the use of groups to construct the code calls for broadcast through the PS.
10. Design Make/Model: Biamp Vocia TTS-1e or Biamp TTS-1nce.

EE. VOIP DEVICE (VOIPD): This unit can be used to receive VOIP calls from an attached VOIP system. These calls can be made live into the PS or via a voice prompt based delayed function. The VOIPD can be used as an emergency input device if required or as a standalone device.

1. Primary and secondary power for VOIPD shall be from approved 24VDC external power source when used as an emergency device.
2. Data communications for the VOIPD shall via Ethernet and wired to the CobraNet VLAN.
3. The VOIPD shall be factory fitted with either 2 or 4 VOIP input lines depending upon installation requirements.
4. The VOIPD shall support Session Information Protocol (SIP), and be capable of supporting G. 711, G.711A, G.722, G.729AB, G.723.1 voice codecs.
5. DTMF tones shall be supported on each VOIP line to trigger PS events.
6. The VOIPD shall support live paging input directly into the PS, and the ability for user defined voice prompts to be supported shall also be possible.
7. Signal processing shall include five band parametric equalization, compression and PIN code access per line.
8. When used as an emergency device the VOIPD must be used in conjunction with the Life Safety Interface enhanced version (LSIe variant) as listed under w. of this specification.
9. Design Make/Model: Biamp Vocia VOIP-1.

FF. FF. POTS DEVICE (POTSD): This unit can be used to receive analog telephone calls from an attached analog phone system (POTS). These calls can be made live into the PS or via a voice prompt based delayed function. The POTSD can be used as an emergency input device if required or as a standalone device.

1. Primary and secondary power for POTSD shall be from approved 24VDC external power source when used as an emergency device.
2. Data communications for the POTSD shall via Ethernet and wired to the CobraNet VLAN.
3. The POTSD shall be factory fitted with either 2 or 4 VOIP input lines depending upon installation requirements.
4. The POTSD shall support Session Information Protocol (SIP).
5. DTMF tones shall be supported on each POTS line to trigger PS events.
6. The POTSD shall support live paging input directly into the PS, and the ability for user defined voice prompts to be supported shall also be possible.
7. Signal processing shall include five band parametric equalization, compression and PIN code access per line.
8. When used as an emergency device the POTSD must be used in conjunction with the Life Safety Interface enhanced version (LSIe variant) as listed under w. of this specification.
9. Design Make/Model: Biamp Vocia POTS-1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Overhead Paging System work.
B. Do not proceed until unsatisfactory conditions have been corrected.
C. Verify compliance of the following items before beginning sound equipment installation.
1. No cables spliced except at standard barrier terminal blocks inside equipment cabinet.

2. Cables marked at each end with permanent wire labels such as Brady or equal.
3. Isolated ground run back to main electrical panel from paging equipment cabinet.
4. Specified conduit, cables, speaker enclosures and equipment cabinets are properly installed.

3.2 INSTALLATION

A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Speakers:
1. Confirm polarity of speaker before installation and wire to maintain uniform polarity.
2. Mount transformers with screws securely to speaker brackets or enclosures.
3. Neatly mount speaker grilles, panels, connector plates, etc., tight, plumb, and square unless indicated otherwise on drawings.
4. Provide brackets, screws, adapters, springs, rack mounting kits, etc., recommended by manufacturer for correct assembly and installation of speaker assemblies and electronics components.
5. Identification:
   a. Legibly identify user operated system controls and system input/output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexon labels. Label equipment and controls within equipment cabinet using similar labels or "Kroy" type labels.

C. Repairs: Wherever walls, ceilings, floors, or other building finishes are cut for installation, the contractor shall be responsible to repair, restore, and refinish to original appearance.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform a complete pretest. Determine the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed. Replace malfunctioning or damaged items with new, and retest until materials satisfactory performance and conditions are achieved.

3.4 COMMISSIONING

A. Occupancy Adjustments: When requested by the Architect or the Sound/Acoustical Consultant within one year of date of substantial completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide two trips for this purpose.

3.5 CLEANING AND PROTECTION

A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION

SECTION 275119 - SOUND MASKING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Networked sound masking systems.
2. Standalone sound masking systems.

B. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for electrical equipment.

1.2 DEFINITIONS

A. FACU: Fire-alarm control unit.

B. N.O.: Normally open.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Networked sound masking systems.
2. Standalone sound masking systems.

B. Shop Drawings:

1. Shop drawings for sound masking systems.

C. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:

1. Networked sound masking systems.
2. Standalone sound masking systems.

B. Field Reports:

1. Manufacturer's field reports for field quality-control support.
2. Manufacturer's field reports for system startup support.
3. Field reports for software and firmware upgrades.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. UL AZOT - Networked sound masking system.
2. UL UEAY - Standalone sound masking loudspeakers.
3. UL AZOT - Single-room sound masking system.

B. Extra Stock Material:

1. UL AZOT - Networked sound masking system.
2. UL UEAY - Standalone sound masking loudspeakers.

1.7 WARRANTY FOR SOUND MASKING SYSTEMS

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed sound masking systems perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: Two years from date of Substantial Completion; full coverage for labor, materials, and equipment.

B. Special Manufacturer Extended Warranty: Manufacturer warrants that sound masking systems perform in accordance with specified requirements and agree to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: five years from date of Substantial Completion; prorated coverage for materials only.

1.8 WARRANTY FOR BATTERIES

A. Special Manufacturer Extended Warranty for Batteries: Manufacturer warrants that batteries perform in accordance with specified requirements and agrees to provide repair or replacement of batteries that fail to perform as specified within extended-warranty period.

1. Initial Extended-Warranty Period for Li-ion Batteries: Three years from date of Substantial Completion; full coverage for materials only, free on board origin freight prepaid.

PART 2 - PRODUCTS

2.1 NETWORKED SOUND MASKING SYSTEMS

A. Description: Electronic noise generators and associated controls for simultaneously operating multiple loudspeakers throughout facility.

B. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. General Characteristics:

a. Reference Standards: Complies with principles and recommended test methods described in ASTM E1374.

C. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

a. Include construction details, material descriptions, dimensions, profiles, and finishes of individual components.
b. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
c. Include certificate of listing and approved markings from qualified electrical testing laboratory for plenum-mounted and rack-mounted equipment.
d. Include sample warranty language.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

D. UL AZOT - Networked Sound Masking System:
1. Biamp sound masking system
2. Cambridge sound
3. Approved Equal
4.

E. Source Limitations: Obtain products from single manufacturer.
1. Listing Criteria:

a. Audio Equipment: Comply with one of the following:

1) UL CCN AZOT; including UL 62368-1.
2) UL CCN AZSQ; including UL 60065 or UL 6500.
3) UL CCN AZJX; including UL 813.

b. Suitable for Installation in Air-Handling Spaces: UL CCN BHZF; including UL 2043.

2. Options:

a. Loudspeaker Mounting: Ceiling
b. Loudspeaker Controller Mounting: Wall.
c. Network Control Panel Mounting: Rack.
d. Masking Sound Frequency Range: 20 Hz to 20 kHz, with equalizers for adjusting the masking sound spectrum at third-octave resolution.
e. Masking Sound Volume Adjustment: Digital control, adjustable in 0.5 dB increments over the range of 34 to 82.5 dB, or a continuous adjustment within that range.
f. Masking Preset Contour Options: 28.
g. Paging Inputs: Provision for connecting microphone, telephone, and auxiliary audio device with analog-to-digital conversion of audio signals.
h. Remote central volume control.

3. Accessories:

a. Spare Parts: Furnish to Owner spare parts, for repairing sound masking equipment, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
1) Provide one speaker for every 15 used on project. Min one.

b. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to sound masking equipment, that are packaged with protective covering for storage on-site and identified with labels describing contents

2.2 STANDALONE SOUND MASKING SYSTEMS

A. Description: Self-contained loudspeaker with electronic noise generator and associated controls.

B. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. General Characteristics:

a. Reference Standards: Complies with principles and recommended test methods described in ASTM E1374.

C. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

a. Include construction details, material descriptions, dimensions, profiles, and finishes of individual components.
b. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
c. Include certificate of listing and approved markings from qualified electrical testing laboratory for plenum-mounted and rack-mounted equipment.
d. Include sample warranty language.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

D. UL UEAY - Standalone Sound Masking Loudspeakers :

1. Biamp standalone sound masking system.

2. Pro Acoustic sound masking system.

3. Cambridge standalone sound masking.

E. Source Limitations: Obtain products from single manufacturer.
1. Listing Criteria:

a. Sound Masking Loudspeakers: UL CCN UEAY; including UL 1480A.
b. Suitable for Installation in Air-Handling Spaces: UL CCN BHZF; including UL 2043.

2. Options:

a. Loudspeaker Mounting: Ceiling, Wall.
b. Loudspeaker Controller Mounting: Wall.
c. Provide input for connection to supervised fire-alarm N.O. contact that when closed mutes loudspeaker.

3. Accessories:

a. Spare Parts: Furnish to Owner spare parts, for repairing sound masking equipment, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
1) Provide one speaker for every 15 used on project. Min one.

b. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to sound masking equipment, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:

F. UL AZOT - Single-Room Sound Masking System:

1. Biamp single room sound masking system.

2. Cambridge single room sound masking system.

3. Pro Acoustic single room sound masking system.

G. Source Limitations: Obtain products from single manufacturer.
1. Listing Criteria:

a. Audio Equipment: Comply with one of the following:

1) UL CCN AZOT; including UL 62368-1.
2) UL CCN AZSQ; including UL 60065 or UL 6500.
3) UL CCN AZJX; including UL 813.

b. Suitable for Installation in Air-Handling Spaces: UL CCN BHZF; including UL 2043.

2. Options:

a. Loudspeaker Mounting: Duct or Ceiling.
b. Loudspeaker Controller Mounting: Wall.
c. Provide input for connection to supervised fire-alarm N.O. contact that when closed mutes loudspeaker.

3. Accessories:

a. Spare Parts: Furnish to Owner spare parts, for repairing sound masking equipment, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
1) Provide one speaker for every 15 used on project. Min one.

b. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to sound masking equipment, that are packaged with protective covering for storage on-site and identified with labels describing contents.

PART 3 - EXECUTION

3.1 PREPARATION

A. Shop Drawings: Prepare and submit the following:

1. Shop Drawings for Sound Masking Systems:

a. Include plans, elevations, sections, details, and attachments to other work.
b. Include schematic of system and floor plan indicating quantity, type, and location of components.
c. Include diagrams for power, signal, and control wiring.
d. Include details supplementing assembly and installation instructions with dimensions, weights, loads, required clearances, methods of field assembly, components, and location and rating of each field connection.

3.2 INSTALLATION OF SOUND MASKING SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation:

1. Audio Equipment and Wiring Methods: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with Article 640 of NFPA 70.
2. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Loudspeaker Installation above Ceiling: Suspend with chains from building structure above ceilings, so bottom of assembly is 6 to 8 inch above upper plane of finished ceiling material. Use eyebolts on speaker assemblies for attachment. Suspend independently from structure, not to supports for components of other building systems.
2. Zoned Loudspeaker Connections: For two- or three-channel systems, connect loudspeaker assemblies alternatively, so masking sound is redundant throughout coverage zones.
3. Wiring Methods:

    a. Cable in Raceway: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and unless otherwise indicated.

        1) Except raceways are not required in accessible indoor ceiling spaces and attics.
        2) Except raceways are not required in hollow gypsum board partitions.
        3) Conceal raceways and wiring, except in unfinished spaces.

    b. Concealed Cable: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
    c. Exposed Cable: Install parallel to building lines, follow surface contours, and support as recommended by manufacturer.

        1) Install plenum cable in environmental air-handling spaces, including plenum ceilings.

    d. Within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

4. Grounding: As recommended by manufacturers unless more stringent requirements are indicated. Ground equipment and conductors to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments with a maximum of 5 Ω to ground at main equipment location. Measure, record, and report ground resistance.
5. Impedance Matching: For system components, including connecting cable, provide end-to-end level and impedance-matched signal paths. Use matching networks and balancing devices at connections where necessary to avoid mismatches.
6. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
7. Identification: Provide labels for vehicle charging equipment and associated electrical equipment.

    a. Use color-coded conductors, and apply wire- and cable-marking tape to designate wires and cables, so media are identified in coordination with system wiring diagrams.
    b. Label loudspeakers as to channel, zone, and address.
    c. Identify field-installed conductors, interconnecting wiring, and components.
    d. Provide warning signs.
    e. Label each enclosure with engraved metal or laminated-plastic nameplate.

D. Interfaces with Other Work:

1. Coordinate installation of new products for sound masking with existing conditions.

2. Coordinate quantity and arrangement of sound masking system components with ceiling space configuration and with components occupying ceiling space, including structural members, pipes, air-distribution components, raceways, cable trays, luminaires, and other items.
3. Coordinate with Section 270528 "Pathways for Communications Systems" for raceway system material, routing, and locations.
4. Coordinate with Fire-Alarm Systems for muting sound masking in event of fire or other emergency.
5. Coordinate with Section 260533.13 "Conduit for Electrical Systems" for installation of raceways.
6. Coordinate with Section 260533.16 "Boxes and Covers for Electrical Systems" for installation of boxes.
7. Coordinate with Section 271513 "Communications Copper Horizontal Cabling" for installation of network cabling, loudspeaker cabling, and Class 2 control cabling.
8. Final connection to FACU where required will be completed by fire-alarm system installer.

E. Systems integration.

3.3 FIELD QUALITY CONTROL OF SOUND MASKING SYSTEMS

A. Acceptance Testing Preparation:

1. Pretesting: Tune, align, and adjust system, and pretest components, wiring, and functions to verify compliance with specified material, installation, and performance requirements. Correct deficiencies and retest until satisfactory performance and conditions are achieved.

B. Field tests and inspections must be witnessed by Tenant.

C. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. Operational Test: Start system to confirm proper operation. Remove malfunctioning units, replace with new units, and retest. Make initial sound-spectrum and -level adjustments for each zone.
3. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
4. Masking Sound Power Level Adjustments: Adjust independently for each space to minimum level between 40 and 50 dB(A-weighted) that will provide speech privacy between adjacent workstations while complying with other system requirements.

D. Final Acceptance Testing: Provide a minimum of 10 days' notice of acceptance test performance schedule. Schedule tests after pretesting has been successfully completed.

1. Perform sound masking evaluation tests in accordance with ASTM E1573, with measurements and calculations in accordance with ASA S3.5.
2. Tests and Calibration Conditions: Spaces are to be completely furnished, but unoccupied; lights and HVAC systems must be on; HVAC system testing and balancing are to be completed; and electronic ballasts, lighting relay panels, and low-voltage transformers must be in place.

3. Test Conditions: Complying with ASTM E1130 and calculated in accordance with ASA S3.5.
4. Instrumentation: Use a professional-quality, sound-level meter with octave-band filters and documentation of recent calibration against recognized standards. Comply with ASA S1.4 Part 1.
5. System Tests: Include the following for each system zone:

    a. Loudspeaker Circuit Impedance Test: Measure impedance at 1000 Hz with amplifier disconnected, using a professional impedance meter or bridge. Locate and correct faults denoted by abnormal readings.
    b. Ambient Sound-Level Tests: With system off, measure ambient sound level in one-third octave bands. Also measure ambient sound level as a single, wide-band, A-weighted reading.
    c. System Noise Test: With masking-noise signal on and amplifiers adjusted at a working level 10 dB above ambient sound level, check for hum, buzz, rattle, or other operating deficiencies.
    d. Spatial Uniformity Test: Measure sound level at locations no greater than 15 ft (4.6 m) on center throughout covered spaces to determine compliance with specified performance level.
    e. Frequency Response Adjustment and Test: Adjust one-third octave frequency bands and other unit filters to provide response. Adjust to meet requirement of space speech intelligibility and quality of background sound. Comply with ASA S3.2, CTA-426, and ASTM E1110.

6. Adjust level of masking sound that is appropriate for area and overall volume.
7. Adjust level of masking sound for each space, so one-third octave band centered at 500 Hz has final selected sound-power level for that space. Measure deviation from listed values in one-third octave bands from 100 to 1000 Hz. Measured values must not deviate from those listed by more than 4 dB for open-plan areas and 8 dB for enclosed offices. The total of individual band deviations in eight bands must not exceed 16 dB for open-plan areas and 30 dB for enclosed offices.
8. Walk-Through Test: People in covered spaces cannot discern loudspeaker locations.

E. Record test observations, readings, and corrective actions. Report test results in accordance with ASTM E1573.

F. Record final control settings and programming, and final tap setting of loudspeaker-matching transformers. Record final sound-level measurements and observations.

G. Nonconforming Work:

1. Units will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

H. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

I. Manufacturer Services: Engage factory-authorized service representative to support field tests and inspections.

1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

3.4 SYSTEM STARTUP

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's published instructions.

B. Manufacturer Services: Engage factory-authorized service representative to support system startup.

1. Manufacturer's Field Reports for System Startup Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

3.5 ADJUSTING

A. Sound Masking Adjustments: Adjust sound masking devices to suit actual occupied conditions.

3.6 CLOSEOUT ACTIVITIES

A. Sustainable Design Closeout Documentation:

1. Submit test report.

3.7 PROTECTION

A. After installation, protect sound masking equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.8 MAINTENANCE

A. Sound Masking Readjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in readjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

B. Software and Firmware Service Agreement:

1. Technical Support: Beginning at Substantial Completion, verify that software and firmware service agreement includes software and firmware support for two years.
2. Upgrade Service: At Substantial Completion, update software and firmware to latest version. Install and program software and firmware upgrades that become available within two years from date of Substantial Completion. Verify that upgrading software includes operating system and new or revised licenses for using software.

   a. Upgrade Notice: No fewer than 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3. Field Reports for Software and Firmware Upgrades: Prepare and submit report after each update, documenting upgrades installed.

END OF SECTION 275119

SECTION 275223
NURSE CALL/CODE BLUE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Specification Section 270000 “Intermountain Healthcare Structured Cabling Standards”.

1.2 SUMMARY

A. Section includes raceways, back boxes, and cabling for a Hill-Rom Navicare Nurse Call (NNC) system.

B. All active components and software to be provided, installed and programmed by Hill-Rom Vendor under contract with the owner.

PART 2 - PRODUCTS

2.1 NURSE-CALL SYSTEM:

A. Nurse-Call System: Hill-Rom Navicare Nurse Call (NNC) System. All electronic components

2.2 CONDUCTORS AND CABLES

A. Data Cable and Hardware: Category 5e, Orange, UTP, and UTP hardware. Comply with requirements in Section 270000.

B. Power Conductors and Cables: Copper, solid, No. 20 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Grounding Conductors and Cables: Copper, stranded, No. 16 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wiring Method:
   1. Install cables in raceways and J-Hooks except within consoles, cabinets, desks, and counters
      a. Conceal raceway and cables except in unfinished spaces.
   2. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
      a. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
      b. Coordinate each outlet box type with Hill-Rom.

B. Install cables without damaging conductors, shield, or jacket.

C. Do not bend cables while handling or installing to radii smaller than those recommended by the manufacturer.

D. Pull cables without exceeding the cable manufacturer's recommended pulling tensions.
   1. Pull cables simultaneously if more than one is being installed in the same raceway.
   2. Use a pulling compound or lubricant if necessary. Use compounds that will not damage the conductor or insulation.
   3. Use pulling means that will not damage the media or raceway, including fish tape, cable, rope, and basket-weave wire or cable grips.

E. Install exposed raceways and cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours. Secure and support cables by straps, staples, or similar fittings designed and installed so as not to damage them. Secure cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding the manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

G. Separation of Wires: Separate speaker/microphone, line-level, speaker-level, and power-wiring runs. Run in separate raceways or, if exposed or in the same enclosure, provide 12-inch (300-mm) minimum separation between conductors to speaker/microphones and adjacent parallel power and telephone wiring. Provide separation as recommended by the equipment manufacturer for other conductors.

H. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Install terminal cabinets where there are splices, taps, or terminations for eight or more conductors.

I. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks if required.

J. Identification of Conductors and Cables: Comply with requirements in Section 271500 "Communications Horizontal Cabling" for cable administration, cable schedule, and cable and wire identification.

K. Equipment Identification:
   1. Comply with requirements in Section 260553 "Identification for Electrical Systems" for equipment labels and signs and labeling installation requirements.
   2. Label stations, controls, and indications using approved consistent nomenclature.

3.2 EXISTING SYSTEMS

A. Examine existing systems for proper operation, compatibility with new equipment, and deficiencies. If discrepancies or impairments to successful connection and operation of interconnected equipment are found, report them and do not proceed with installation until directed. Schedule existing systems' examination so there is reasonable time to resolve problems without delaying construction.

3.3 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazards and minimize ground loops, common-mode returns, noise pickup, crosstalk, and other signal impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding except at connection to main building ground bus.

C. Grounding Provisions: Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 275319
Internal Cellular, Paging, and Antenna Systems

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of the following Division 26 Sections apply to this Section:
   1. Basic Electrical Requirements.
   2. Basic Electrical Materials and Methods.

1.2 SUMMARY

A. The DAS system is provided and installed by a third-party vendor as an Owner-provided, owner-installed (OFOI) system, contracted and managed by Intermountain CTIS/Telecom Team.

B. A/E to coordinate DAS requirements with the Owner's vendor to incorporate necessary infrastructure on their drawings to support a fully functional DAS system.

PART 2 - EXECUTION

2.1 INSTALLATION

A. The DAS contractor is to install their equipment in the TDRs in the assigned Rack location, as noted in the ET TDR Room Elevation Drawings.

B. DAS contractor will install any wall-mounted equipment in the TDRs in the assigned location as noted in the ET TDR Room Elevation drawings.

C. The CTIS/Telecom team will need to provide specific power requirements in the project's design phase.

D. Cable installation will follow Division 27 installation specifications.

E. The fiber DAS distribution shall be installed in a star topology from the DAS room to all TEC/TDRs.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 276001

APPENDIX 01 – Deviation Request Process

PART 1 - GENERAL

1.1 DEFINITIONS

A. Cable Plant Deviation
   1. A business deviation to not fully comply with the requirements of the "Division 27 – Communications and Structured Cabling Specification document"

B. Cable Plant Deviation Request form.
   1. The document is available from the Facilities Planning team, the Data Center Ops team, or the Infrastructure Cabling team.
   2. Usage:
      a. The deviation request form shall be used if there is a business need to not comply with the requirements of the "Division 27 – Communications and Structured Cabling Specification document."
      b. The deviation request form should also be used to propose a change to that document. Always verify that you are using the current version of the Standard before requesting a modification.

PART 2 - PROCESS

2.1 STANDARDS MODIFICATION

A. Check the box and explain why the standard should be modified.

2.2 ALTERNATE PRODUCT

A. The deviation form must be completed, submitted through channels, and approved prior to any deviation from the specifications. This includes issuing change orders.

2.3 AUTHORIZED SIGNATURES

A. Both the Standards Holder and the DCO Manager signatures are required for a deviation to be valid.

2.4 DEVIATION REVIEW PROCESS STE

A. First be sure that there is an actual need. Then be certain that your manager, supervisor, or project manager agrees with the requested deviation. Be sure to state this or obtain their signature on the deviation form. By doing so you are confirming that your supervisor or project manager has approved.

B. The requestor will then complete sections 1, 2, and 3 of the deviation form.
   1. The requestor should then digitally sign in the designated location at the end of Section 3. Do not write in the sections below 3.

A. Forward the saved copy of this form to the Standards Holder via email.
   1. Email to: melissa.lopez2@imail.org

B. The Standards Holder will then review and evaluate the request. The requestor should be prepared to provide plans, specifications, and competitive bids if requested.

Any email threads or meeting discussions regarding the issue will be taken into consideration.

C. The Standards Holder will then cast an Approve or Deny vote and forward the request to the DCO Manager for a decision.

D. When the decision has been made by the DCO Manager, the Standards Holder will then notify the requester by returning the completed and signed form via email.

E. An approved deviation will have the final disposition button 'Approved' and be signed by
at least 2 people. One will be from the Standards Holder, and the other the DCO Manager. Other signatures may be required for specific features and areas such as Safety, Security, Print, Medical group, etc.

F. The deviation request is only good for the specific project that it was submitted on. A change to Division 27 is required for the deviation to be in place moving forward on all future projects.

PART 3 - EXECUTION

3.1 POST DECISION EXECUTION

A. DENIED
1. If the requester is not satisfied with the decision, they may file an appeal with the Data Center Operations manager (shawn.folkman@imail.org), who will then escalate the issue to the appropriate business leaders as needed. The decision from the appeal is final.

B. APPROVED
1. If a deviation is approved for contracted material, labor, or method; the facilities project manager will arrange for fulfillment or contract adjustment as needed via appropriate contract channels such as change orders.

END OF SECTION

SECTION 276002
APPENDIX 02 – Document Refresh Process

PART 1 - GENERAL

1.1 NOT USED

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

A. This section aims to help ensure a current standards document.
   1. The product delivered will be a current revision or version of the Cable Plant Standards Document.
   2. The Enterprise Infrastructure Cabling team must approve all changes.

PART 3 - EXECUTION

3.1 REVIEWS AND UPDATES

A. Minor updates
   1. Changes that do not significantly affect the scope of work or contract pricing will be made, and the Rev number will be updated (i.e., updated part numbers, etc.).
   2. Significant changes will be added to the Change Log for review and approval from the DCO/Infrastructure Cabling Team.
      a. When approved, they will be implemented in the new Version.

B. Major updates
   1. The DCO/Infrastructure Cabling Team will review the entire document at least once every three years.
   2. This review will coincide with the release of new versions of NFPA70 (National Electrical Code) (2017, 2020, etc. - to be completed by the end of each designated year).
   3. The review will cover standards adjustments that may be deemed necessary and ensure compliance with applicable codes and standards.
   4. The standards document will be submitted for approval upon completion of the reviews and updates.

END OF SECTION

Model	Manufacture	Part Number	Description	Notes
Eaton Single-Phase UPS				
5S UPS	Eaton	5S550	550VA/330W, 120V Line Interactive UPS	
9PX UPS	Eaton	9PX1000RT	1000VA/900W, 120V Online UPS, RM or Tower	
9PX UPS	Eaton	9PX1500RTN	1500VA/1350W, 120V Online UPS, RM or Tower, Includes NETWORK-M3 Card	
9PX UPS	Eaton	9PX2000RTN	2000VA/1800W, 120V Online UPS RM, or Tower, Includes NETWORK-M3 Card	
9PX UPS	Eaton	9PX3000RTN	3000VA/2700W, 120V Online UPS RM, or Tower, Includes NETWORK-M3 Card	
9PX UPS	Eaton	9PX3K3UNP1	3000VA/2700W, 208/240V to 120V Online UPS, RM or Tower, Includes NETWORK-M3 Card	
Bypass Option 9PX 1-3kVA	Eaton	9PXEBM72RT	EBM for use with 9PX2000RTN & 9PX3000RTN UPS	
Network Card option 9PX 1-3K	Eaton	NETWORK-M3	Eaton Gigabit Network Card	
Rack mount kit 9PX 1-3kVA Option	Eaton	RK2PC	2-post rack mounting kit for 1-6kVA UPS & EBM	
9PX SP UPS	Eaton	9PX6KSP	5500VA/4900W, 120/208 or 120/240V Split-Phase Online UPS, RM or Tower, Includes NETWORK-M3 Card	
Model	**Manufacture**	**Part Number**	**Description**	**Notes**

9PX SP UPS	Eaton	9PX8KSP	8000VA/7200W, 120/208 or 120/240V Split-Phase Online UPS, RM or Tower, Includes NETWORK-M3 Card	
9PX SP UPS	Eaton	9PX10KSP	10000VA/9000W, 120/208 or 120/240V Split-Phase Online UPS, RM or Tower, Includes NETWORK-M3 Card	
Bypass 9PX SP 6-10kVA, 9PXM	Eaton	BPM125HW	Bypass Power Module for 6, 8 &10kVA 9PX Split-Phase, 9PXM & 9155 UPS, Hardwired Input/Ouput	
9PXM UPS	Eaton	9PXM8S8K	8kVA expandable to 16kVA, (1) 8-slot enclosure, (2) power modules, (4) battery modules, (1) network card, Hardwired Input/Output	
9PXM UPS	Eaton	9PXM8S12K	12kVA expandable to 16kVA, (1) 8-slot enclosure, (3) power modules, (6) battery modules, (1) network card, Hardwired Input/Output	
9PXM UPS	Eaton	9PXM8S16K	16kVA, (1) 8-slot enclosure, (4) power modules, (8) battery modules, (1) network card, Hardwired Input/Output	
9PXM UPS	Eaton	9PXM12S12K	12kVA expandable to 20kVA N+1, (1) 12-slot enclosure, (3) power modules, (6) battery modules, (1) network card, Hardwired Input/Output	
Model	**Manufacture**	**Part Number**	**Description**	**Notes**

9PXM UPS	Eaton	9PXM12S16K	16kVA expandable to 20kVA N+1, (1) 12-slot enclosure, (4) power modules, (8) battery modules, (1) network card, Hardwired Input/Output	
9PXM UPS	Eaton	9PXM12S20K	20kVA expandable to 20kVA N+1, (1) 12-slot enclosure, (5) power modules, (10) battery modules, (1) network card, Hardwired Input/Output	
PDU's				
Smart PRO1 PDU	Server Tech	C1C10SA-2CBA2B4	Smart Primary PRO1 PIPS PDU, 1U, (10) HDOT Outlets (6xC13 + 4xCx), Input Amp Meter, 208V 30A, NEMA L6-30P, 10 ft (3m) Input Cord, Circuit Breakers, (2) Temperature/Humidity Sensor Capable	Horizontal
Smart POPS PRO2 PDU	Server tech	C2SG36TE-DQME2M66/ZB	Smart POPS Primary PRO2 (36) Alt Phase HDOT Outlets (24xC13 + 12xCx), 208V 3PH Delta 6BR 60A, IP67 Water-tight IEC60309 3m/10ft cord, Auto-Orient Mid Display, Bottom Cord Entry, Doghouse Breakers, Phase Monitoring, Blue Highlights	Vertical
Smart POPS PRO2 PDU	Server tech	C2LG36TE-DQME2M66/ZR	Smart POPS Expansion PRO2 (36) Alt Phase HDOT Outlets (24xC13 + 12xCx), 208V 3PH Delta 6BR 60A, IP67 Water-tight IEC60309 3m/10ft cord, Auto-Orient Mid Display, Bottom Cord Entry, Doghouse Breakers, Phase Monitoring, Red Highlights	Vertical
Model	**Manufacture**	**Part Number**	**Description**	**Notes**

Smart POPS PRO2 PDU	Server Tech	C2SG36TE-DCMFAM66/C	Smart POPS Master PRO2 (36) Alt Phase HDOT Configurable Outlets, 208V 3PH Delta 3BR 30A L15-30P 3m/10ft cord, Auto-Orient Mid Display, Bottom Base Cord Entry, Doghouse Breakers, Phase Monitoring, WxD = 2.20in x 2.50in	Notes
Smart PRO1 PDU	Server Tech	C1S24VS-YCFA13C9/C	Smart PRO1 Primary, 0U, 18 x IEC C13 and 6 x IEC C19 Outlets, 1 x NEMA 5-20R Utility Outlet, 3 x LED Amp Meters, 3-phase Wye 30A Input w/ NEMA L21-30P Connector, 10ft (3m) Cord (Bottom/base Entry), (2) Temperature/Humidity Sensor Capable, with Retractable Fuses	Vertical
Smart PRO1 PDU	Server Tech	C1L24VS-YCFA13C9/C	Smart PRO1 Expansion, 0U, 18 x IEC C13 and 6 x IEC C19 Outlets, 1 x NEMA 5-20R Utility Outlet, 3 x LED Amp Meters, 3-phase Wye 30A Input w/ NEMA L21-30P Connector, 10ft (3m) Cord (Bottom/base Entry), (2) Temperature/Humidity Sensor Capable, with Retractable Fuses	Vertical
Smart PRO1 PDU	Server Tech	STV-3531C	Smart PRO1, PIPS (Per Input Power Sensing), 0U, (24) IEC C13 + (6) IEC C19 Outlets, (1) LED Current Meter w/ Auto-flip, 208-240V 30A, NEMA L6-30P Plug, 10 ft (3m) Cord w/ Power Pivot Cord Entry, Middle Display/Network, (2) Temperature/Humidity Sensor Capable, Circuit Breakers	Vertical
Model	**Manufacture**	**Part Number**	**Description**	**Notes**

Smart PRO1 PDU	Server Tech	SEV-3531C	Smart PRO1 (Expansion Unit), PIPS (Per Input Power Sensing), 0U, (24) IEC C13 + (6) IEC C19 Outlets, (1) LED Current Meter w/ Auto-flip, 208-240V 30A, NEMA L6-30P Plug, 10 ft (3m) Cord w/ Power Pivot Cord Entry, Middle Display/Network, (2) Temperature/Humidity Sensor Capable, Circuit Breakers	Vertical
MN03E1R0-10D203-2TL5A0H10-S	Vertiv/Geist PDU	NI30202	Unit-level monitored PDU, 20A, 120V, rackmount, 10x rear NEMA 5-20R receptacles	Horizontal
MNR3E1R6-12CF18-3TL6A0H10-S	Vertiv/Geist PDU	NR30206	12-Outlets PDU - Monitored - NEMA L6-30P - 12 x Combination C13/C19 - 230 V AC - Network (RJ-45) - Horizontal - Rack-mountable - Horizontal	Horizontal
MN03E4W1-44MB19-3TL21A0B10-S	Vertiv/Geist PDU	VP8865	rPDU, Monitored Unit Level EC, 30A, 120/208V WYE, 8.6kW, Vertical, (36) IEC C13, (6) IEC C19, (2) NEMA 5-20R, 10ft power cord with L21-30P, Black Powder Coat.	Vertical
ePDU	Eaton	EMIT06-10	Metered Input ePDU, 208V, 5.76 Max. kW, L6-30P Input (10ft), (10) C13, (4) C19 Output, 1U	
ePDU	Eaton	EMIT09-10	Metered Input ePDU, 120V, 1.92 Max. kW, L5-20P (5-20P adapter) Input (10ft), (8) 5-20R Output, 1U	
Model	**Manufacture**	**Part Number**	**Description**	**Notes**
T- Sensor ePDU	Eaton	EMPDT1H1C2	Environmental Monitoring Probe Gen 2	

eATS	Eaton	EATS120	Rack Mount Automatic Transfer Switch, Non-phase Synchronized Switching Compatible, 120V, 1.92 Max. kW, (2) 5-20P (10ft) Input, (10) 5-20R Output, 1U	
eATS	Eaton	EATS30P	Rack Mount Automatic Transfer Switch, Non-phase Synchronized Switching Compatible, 208V, 5.76 Max. kW, (2) L6-30P (10ft) Input, (1) L-6-30R Output, 1U	
Power Cords				
Dual Lock Power Cord	StayOnline Power Cords	5656N	IEC320 C14 Male Plug to C13 Connector Dual-Lock 1.8 meters / 6 feet 10A/250V 18/3 SVT Red - Locking Power Cord	
Dual Lock Power Cord	StayOnline Power Cords	6694N	IEC320 C14 Male Plug to C13 Connector Dual-Lock 1.8 meters / 6 feet 10A/250V 18/3 SVT Blue - Locking Power Cord	
Dual Lock Power Cord	StayOnline Power Cords	5914N	IEC320 C20 Male Plug to C19 Connector Dual-Lock 1.8 meters / 6 feet 20A/250V 12/3 SJT Red - Locking Power Cord	
Dual Lock Power Cord	StayOnline Power Cords	6766N	IEC320 C20 Male Plug to C19 Connector Dual-Lock 1.8 meters / 6 feet 20A/250V 12/3 SJT Blue - Locking Power Cord	
NEMA to IEC Power Cord	StayOnline Power Cords	9008	NEMA 5-15 Male Plug to IEC320 C13 Connector 1.8 meters / 6 feet 15A/125V 14/3 SJT Red - Power Cord	
Model	**Manufacture**	**Part Number**	**Description**	**Notes**
NEMA to IEC Power Cord	StayOnline Power Cords	7978	NEMA 5-15 Male Plug to IEC320 C13 Connector 1.8 meters / 6 feet 15A/125V 14/3 SJT Blue - Power Cord	

P-Lock Power Cord	StayOnline Power Cords	9144	IEC320 C14 Male Plug to C15 Connector P-Lock 1.8 meters / 6 feet 15A/250V 14/3 SJT Red - Locking Power Cord	
P-Lock Power Cord	StayOnline Power Cords	9138	IEC320 C14 Male Plug to C15 Connector P-Lock 1.8 meters / 6 feet 15A/250V 14/3 SJT Blue - Locking Power Cord	
Mechanical				
VRC	Vertiv		3.5kW Rack Mounted Cooling Unit	VRC100 (Self Contained Version)
Mini-Mate 3	Liebert	MT036HE1A00XCH	Ceiling mounted thermal management system, direct expansion unit.	
Mini-Mate 4	Liebert	MT048HE1A00AP4	Ceiling mounted thermal management system, direct expansion unit.	
Mini-Mate 5	Liebert	MT060HE1A00WPZ	Ceiling mounted thermal management system, direct expansion unit.	
Mini-Mate 3	Liebert	MMD40C2AJ0D5	Ceiling mount chilled water unit	
Mini-Mate 5	Liebert	MMD92CDAJ0L5	Ceiling mount chilled water unit	
CRV	Liebert	CR020RA1A70A71	Row-Based Environmental Control System, DX direct expansion 5 ton Unit	
Model	**Manufacture**	**Part Number**	**Description**	**Notes**
CRV	Liebert	CR035RA1A70A71	Row-Based Environmental Control System, DX direct expansion 10 ton Unit	

CRV	Liebert	CR032RC1A2SH	Row-Based Environmental Control System, Chilled water 5 ton unit	
CRV	Liebert	CR040RC1A2SH	Row-Based Environmental Control System, Chilled water 10 ton unit	
Cable Ladder Tray				
Cable Runway	CHATSWORTH	10250-724	CABLE RUNWAY - 24", BLACK WITH ALL REQUIRED MOUNTING ACCESSORIES	
Cable Runway	CHATSWORTH	10250-718	CABLE RUNWAY - 18", BLACK WITH ALL REQUIRED MOUNTING ACCESSORIES	
Butt Splice	CHATSWORTH	11301-701	BUTT SPLICE KIT, Black	
Junction Splice	CHATSWORTH	11302-701	JUNCTION SPLICE KIT	
Foot kit	CHATSWORTH	11309-701	FOOT KIT, BLACK	
Rack to Runway	CHATSWORTH	12409-724	6" CHANNEL RACK TO RUNWAY, BLACK	
Triangle Bracket	CHATSWORTH	11746-718	18" TRIANGLE BRACKETS, BLACK	
Triangle Bracket	CHATSWORTH	11746-724	24" TRIANGLE BRACKETS, BLACK	
End Closing Kit	CHATSWORTH	11700-724	END CLOSING KIT, CABLE RUNWAY, BLACK	
Wall Angle Support Kit	CHATSWORTH	11421-718	18" WALL ANGLE SUPPORT KIT, CABLE RUNWAY, BLACK	
Model	**Manufacture**	**Part Number**	**Description**	**Notes**
Wall Angle Support Kit	CHATSWORTH	11421-724	24" WALL ANGLE SUPPORT KIT, CABLE RUNWAY, BLACK	

Elevation Kit	CHATSWORTH	10506-706	CABLE RUNWAY ELEVATION KIT, 6"	
Radius Drop	CHATSWORTH	12100-712	CABLE RUNWAY RADIUS DROP	
DC Fiber modules & Jumpers				
Wall Mount Module Box	SIEMON	**WMF-A-01**	Wall Mount Module Box, OM4 Aqua, LC/MTP	
Wall Mount Module Box	SIEMON	**WMF-B-01**	Wall Mount Module Box, OM4 Violet, LC/MTP	
Fiber Patch Cable	SIEMON	**LBP-LCULCUL-(XX)**	PATCH CABLE LBP, FIBER, SINGLEMODE DUPLEX W/LC CONNECTORS, YELLOW, (XX) = LENGTH IN METERS	
Fiber Patch Cable	SIEMON	**LBP-LCLC5V-(XX)AQ**	PATCH CABLE LBP, FIBER, MULTIMODE DUPLEX W/LC CONNECTORS, AQUA, (XX) = LEGTH IN METERS	
Fiber Patch Cable	SIEMON	**LBP-LCLC5V-(XX)EQ**	PATCH CABLE LBP, FIBER, MULTIMODE DUPLEX W/LC CONNECTORS, ERIKA VIOLET, (XX) = LEGTH IN METERS	
Foreseer Cable, 2 Pair	Belden	88723		
Cold/Hot aisle containment provided by Data Center Operations				
Electronic Key Cylinders				
Cylinder	Medeco	100500 G	1 ¼” Mortise Cylinder	
Cylinder	Medeco	100400H G	Rim Cylinder, Horizontal Tailpiece	
Cylinder	Medeco	EA-100108	Small Format Interchangeable Core (SFIC) Cylinder	
Model	**Manufacture**	**Part Number**	**Description**	**Notes**
Cylinder	Medeco	20200S1 G	Cylinder Package for Schlage	
Cam Lock	Medeco	EN-150002-219	7/8” Cam Lock Assembly, Key Retaining	
Cam Lock	Medeco	EN-150003-219	1 1/8” Cam Lock Assembly, Key Retaining	
Cylinder for Legrand cabinet front door	Medeco	232301S 800 G	Modular Profile Cylinder – 30mm Half Profile - Assembled	

Electronic Key	Medeco	94-0271	Medeco Slim Line Key (G2) & Charger Bundle	
Programming Station for Small Locations	Medeco	EA-100109	Medeco XT Desktop USB Programming Station (not preferred)	
Programming Station for Large Locations	Medeco	EA-100158	Medeco XT Wall USB Programming Station (preferred)	
Wall Mount for Wall Programmer	Medeco	94-0294	Medeco XT Remote Wall Programmer Wall Mount Kit	
Padlock	Master	6842D045KZ	Padlock for use with Electronic Cylinder	

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 276004
APPENDIX 04 – Reference Standards

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

A. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed below:
   1. ANSI/TIA-568.0-D and addenda “Generic Telecommunications Cabling for Customer Premises
   2. ANSI/TIA-568.1-D and addenda “Commercial Building Telecommunications Cabling Standard
   3. ANSI/TIA-568.2-D and addenda “Balanced Twisted-Pair Telecommunications Cabling and Components
   4. ANSI/TIA-568.3-D and addenda “Optical Fiber Cabling Components Standard”
   5. ANSI/TIA-568.4-D and addenda “Broadband Coaxial Cabling and Components Standard”
   6. ANSI/TIA-569-D and addenda “Telecommunications Pathways and Spaces”
   7. ANSI/TIA-606-C and addenda “Administration Standard for Commercial Telecommunications Infrastructure”
   8. ANSI/TIA-607-D and addenda “Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises”
   9. ANSI/TIA-758-B “Customer-Owned Outside Plant Telecommunication Infrastructure Standard”
   10. IEEE 802.3at PoE Plus and Next Gen PoE CFI March 2013 and IEEE P802.3ba latest draft revision and amendments.
   11. “Media Access Control Parameters, Physical Layers and Management Parameters for 40 Gbp/s and 100 Gbp/s Operation”.
   12. ANSI/TIA-526-7-A “Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant”
   13. ANSI/TIA/EIA-526-14-C “Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant”
   14. ANSI/TIA-942-B “Telecommunications Infrastructure Standard for Data Centers”
   15. ANSI/TIA – 1179-A “Healthcare Facility Telecommunications Infrastructure Standard”
   16. IEC/TR3 61000-5-2 - Ed. 1.0 and amendments “Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling.”
   17. ISO/IEC 11801-1 (2017) and amendments “Information technology - Generic cabling for customer premises – PART 1: General Requirements”
   18. EN 50173-1 and amendments “Information Technology - Generic cabling systems – PART 1 General Requirements”
   19. AIA Guidelines for Design and Construction of Hospital and Healthcare Facilities
   20. Construction Specification Institute Master Format
   21. BICSI: Comply with the most current editions of the following BICSI manuals:
      a. BICSI - Telecommunications Distribution Methods Manual
      b. BICSI – Installation Transport Systems Information Manual
      c. BICSI – Network Design Reference Design Manual
      d. BICSI – Outside Plant Design Reference Manual
      e. BICSI – Wireless Design Reference Manual
      f. BICSI -Electronic Safety and Security Design Reference Manual

g. Infocomm/BICSI – AV Design Reference Manual
22. Underwriters Laboratories (UL) Cable Certification and Follow-Up Program.
23. National Electrical Manufacturers Association (NEMA)
24. American Society for Testing Materials (ASTM)
25. National Electrical Code (NEC) NFPA70 2020
26. National Electrical Safety Code (NESC) 2017
27. Institute of Electrical and Electronic Engineers (IEEE)
28. UL Testing Bulletin
29. Building Industry Consulting Services International (BICSI) Information Transport Systems Methods Manual (ITSMM)
30. Local, county, state and federal regulations and codes in effect as of date of installation.
31. Equipment of foreign manufacture must meet U.S. codes and standards. It shall be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

END OF SECTION

SECTION 276005

APPENDIX 05 – Definitions and Abbreviations

PART 1 - GENERAL

1.1 RELATED TERMS

A. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed below:
   1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
   2. BICSI: Building Industry Consulting Service International.
   3. CBC: Coupled Bonding Conductor
   4. CFCI: Customer Furnished Customer Installed
   5. Cable Run - A single cable to a single location
   6. Cable Drop - Two cables to a single location
   7. Cable Tri Drop - Three cables to a single location.
   8. CT Coupler A type of wall connector made by the Siemon Company
   9. DCO: Data Center Operations
   10. Div.1: Division 1 General and Performance Requirements
   11. Div. 23: Division 23 Heating, Ventilating, and Air Conditioning
   12. Div. 22: Division 22 Plumbing
   13. Div. 26: Division 26 Electrical
   14. Div. 27: Division 27 Communications and Audio Visual
   15. Div. 28: Division 28 Electronic Safety and Security
   16. E.E.: Electrical Engineer
   17. EMI: Electromagnetic Interference
   18. F/UTP: Foil over Unshielded Twisted Pair. Individual pairs are unshielded.
   19. GC: General Contractor
   20. GE: Ground Equalizer
   21. Horizontal Cabling: The cable and connecting hardware utilized to transport communications signals.
   22. ICT: Infrastructure Cabling Team
   23. LAN: Local Area Network
   24. N/A: Not Applicable
   25. NIC: Not in Contract
   26. OFCI: Owner Furnished Contractor Installed
   27. OFOI: Owner Furnished Owner Installed
   28. OTDR: Optical Time Domain Reflectometer
   29. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
   30. RCDD: Registered Communications Distribution Designer
   31. RFI: Radio Frequency Interference
   32. TBA or TBD: To Be Determined
   33. TDR: Technology Distribution Room
   34. TEC: Technology Equipment Center
   35. TGB: Telecommunications Ground Bus Bar
   36. TMBC: Telecommunications Main Bonding Conductor
   37. TMGB: Telecommunications Main Grounding Bus Bar
   38. TSER: Telecommunications Service Entrance Room

39. UTP: Unshielded Twisted Pair
40. Work Area: approx. 100 sq. ft. equipped for workstation equipment.
41. DCO = Data Center Operations – Boe.Sausedo@imail.org
42. ICT = Information and Communications Technology – Melissa.Lopez2@imail.org

END OF SECTION

SECTION 276006

APPENDIX 06 – MATERIAL SUPPLIERS

PART 1 - GENERAL

1.1 RELATED TERMS

A. Siemon Authorized Suppliers are listed below. To help prevent counterfeiting and support warranties, known, factory-authorized distributors are recommended.
   1. Approved Suppliers of Siemon cable, patch panels, jacks, and parts:

Wesco/Anixter
Randi Whittaker
Inside Sales — Main Phone: (801) 973-2121
3775 W. California Ave. Ste 400 — Fax: (801) 973-4472
Salt Lake City, UT 84104 US — Email: randi.whittaker@anixter.com

Karl Bartlam
End User/Outside Sales — Main Phone: (801) 973-2121
3775 W. California Ave. Ste 400 — Fax: (801) 973-4472
Salt Lake City, UT 84104 US — Email: karl.bartlam@anixter.com

Graybar Electric
Elizabeth Vaughn
Inside Sales — Main Phone: (801) 656-3016
2841 South 900 West — Fax: (801) 973-4314
Salt Lake City, UT 84119 US — Email: Elizabeth.Vaughn@graybar.com

Erika Morrison
Contractor Outside Sales — Main Phone: (801) 656-3014
2841 South 900 West — Fax: (801) 973-4314
Salt Lake City, UT 84119 US — Email: Erika.Morrison@graybar.com

WESCO / CSC
Brian Walters
Inside Sales — Main Phone: (801) 975-0600
3210 South 900 West — Fax: (801) 907-4450
Salt Lake City, UT 84119 US — Email: Bwalters@gocsc.com

Adam Tueller
Contractor Outside Sales — Main Phone: (801) 975-0600
3210 South 900 West — Direct: (801) 618-6665
Salt Lake City, UT 84119 US — Email: Atueller@gocsc.com

B. The Siemon Company is represented locally by: Easton_Jones@siemon.com

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 276007
APPENDIX 07 – Siemon Certified Installation Firms

PART 1 - GENERAL

1.1 RELATED TERMS

NOTE: CABLE INSTALLERS HAVE RIGOROUS REQUIREMENTS TO BE CERTIFIED FOR SIEMON CABLES AND PRODUCTS. VALIDATION OF CERTIFICATION IS REQUIRED PRIOR TO ACCEPTING A BID.

A. The firms selected to bid must be pre-approved by the local facility IT manager. Installation firms desiring to do work for Intermountain Health must be selected from the official CI list below.

B. Current Siemon Approved/Certified Cable Installers for Siemon Network Cable. This list is up to date as of 2025-01-03.
   1. Orion Integration Group: 8880 W. Barnes Street, Boise, ID 83709
      a. Greg Chavez // Phone 208 321 8000 / Fax 208 321 8555 / Direct 208 489 2230 // Gchavez@io-group.com / www.oi-group.com
   2. ACS Systems: 925 North Main St. Meridian, ID 83642
      a. Doug McCleery // Phone 208 331 8554 / Fax 208 884 5638 / Mobile 208 412 5763 // doug@acs-systems.com / www.acs-systems.com
   3. IES Commercial: 16292 So. Bringhurst Boulevard, Suite 700, Bluffdale, UT 84065
      a. Brad Davis – Branch Manager // Phone 801 975 8182 / Fax 385 242 7366 / Mobile 385 448 7175 // Brad.Davis@iescomm.com / www.iescomm.com
   4. Cache Valley Electric: 1338 S. Gustin Rd., Salt Lake City, UT 84104
      a. Travis Grant – Acct. Manager // Phone 801 908 4170 / Fax 801 908 7401 Mobile 801 870 7226 // Travis.Grant@cve.com / www.cve.com
      b. Brad Readicker – Acct. Manager // Phone 801 908 2686 / Fax 801 908 7401 Mobile 801 870 4963 // Brad.Readicker@cve.com / www.cve.com
   5. Hunt Electric, Inc.: 1863 W. Alexander St., Salt Lake City, UT 84119
      a. Colton – Technology Division Manager // Phone 801 975 8844 Mobile 385 505 2662 // Colton. @huntelectric.com / www.huntelectric.com
   6. Linx: 167 West 7065 South, Midvale UT 84047
      a. Mike Herd – Account Executive // Mobile 801 702 7083 // MHerd@teamlinx.com / www.teamlinx.com
      b. Steve Faddis – Project manager // Mobile 385 707 5168 // SFaddis@teamlinx.com / www.teamlinx.com
   7. Data Plus: 769 Middlegate Road, Henderson, NV 89118
      a. Chris Tettamanti – Project Manager // Phone 702 795 3282 Chris@dpcnv.com
   8. Bombard Electric: 4380 West post Road, Las Vegas, NV 89118
      a. Bob Reese – Project/Division Manager // Phone 702 263 3570 Bob.reese@bombardelec.com / www.bombardelectric.com
   9. Fisk Electric: 6412 Arville Street, Las Vegas, NV 89118
      a. Anthony Sant – Operations Manager // Phone 702 435 5053 / Fax 702 435 2127 / Mobile 702 373 6969 // Asant@fiskcorp.com / www.fiskcorp.com
   10. Mojave Electric: 3755 W. Hacienda Ave., Las Vegas, NV 89118 Phone 702 798 2970
   11. The Morse Group: 3874 Silvestri Lane, Las Vegas, NV 89120
      a. Chuck Sudberry – Group Manager Low Voltage // Phone 702 257 4452 Mobile 702308 4410 // Csudberry@themorsegroup.com/ www.themorsegroup.com
   12. Linx: 9900 E 51st Ave., Denver, Co 80238

a. John Lopez // Phone 303 500 2860 // JLopez@teamlinx.com

13. TelNet Systems: 547 S 20th Street West, Suite #2, Billings, MT 59102
    a. Clay Jensen // Phone 406 855 7478 // Clay.Jensen@telnetsystemsmt.com

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 276008
APPENDIX 08 – Lead Wall Penetrations

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Sections 13090 & 134900

1.2 RELATED TERMS

Procedure Name: New Port and Electrical Box Installation Lead Lined Walls
Document Detail Information: (This section must be completed in full.)

Implements Policy:	Click here to enter policy title		
Content Owner	Craig Allen, Safety Security Environment Health Director, Central Office Jeremy Hawk Medical Physicist Radiation Safety Coordinator	Content Consultant(s):	Jeremy Hawk, Radiation Safety Officer, Medical Physicist Imaging John Ellis, Facilities Management Director, Central Office Steve Kelly, System Project Facility Design Manager, Planning Melissa Lopez, Cabling, IS
Date of Final Draft:	12/29/2015	Who Reviewed Content?	<Name, Title, Dept> <Name, Title, Dept> <Name, Title, Dept> <Committee Name>
Keywords (must have at least 3):	Searchable Keywords (e.g., PHI, EMTALA, Coding)		

PART 2 -

2.1 PURPOSE

A. Maintain radiation safety controls in lead lined walls during installation of new power and data outlets in existing lead lined walls.

2.2 SCOPE

A. Intermountain Hospitals, Intermountain Clinics Medical Group

2.3 DEFINITIONS

A. Lead lined Walls – Structured element designed to provide a barrier to block radiation penetration beyond the designated space.

B. Maintenance Manager – The person responsible for plant maintenance operations or his/her delegate.

C. Radiation Safety Coordinator – The person responsible for Radiation Safety or his/her

D. Delegate. Medical Physicist.

E. Worker – The person responsible for completing work with the lead lined wall. This includes Intermountain Employees as well as any outside supplier or contractor.

2.4 PROVISIONS

A. The Radiation Safety Program is following Utah regulation R313-15-101, R313-28 and U.S. Nuclear Regulatory Commission Regulation 1- CFR Part 20-1101.

2.5 PROCEDURE

A. Prior to any work within a lead lined wall, the Worker reports to the Radiation Safety Coordinator, Maintenance Manager and completed a review of planned work “ACWP” Identification of specific description related to the lead lined wall planned work.
   1. Intermountain workers, outside suppliers or contractors hired to work in any Intermountain facility must contact the Maintenance Manager and Radiation Safety Coordinator prior to beginning work to discuss the project and ensure that the planned work will not interfere with facility operations, maintenance, or other projects.
   2. Failure to schedule and complete the planning meeting described above may result in the delay or rescheduling of work. Outside suppliers or contractors are responsible for any costs incurred because of their failure to schedule and complete this meeting.

B. The Radiation Safety Coordinator, Maintenance Manager and the worker conduct a pre-work inspection of the areas in which work is to be performed. This inspection identified the following:
   1. Areas of special concern or sensitivity, including those noted or described on the facility Life Safety records and drawings, and Radiation Safety records and drawings.
   2. Appropriate areas or structures to use for support of any work, as applicable.
   3. Existing deficiencies in Barriers.
   4. The as act assemblies impacted by the work.
   5. The type of shielding material acceptable in the area.
      a. Lead lined boxes
      b. Lead lined wall “inside wall” installation, and OR
      c. Lead shielding for wall installation of “outside wall” maintaining radiation safety barriers.
   6. The exact condition of the areas upon completion of work.

C. Upon completion of the work and before closing the wall, the worker, Radiation Safety Coordinator and Maintenance Manager conduct a post-work inspection of the area in which the work was performed, this inspection verifies the following:
   1. No Tools, Supplies or debris are left within the walls.
   2. Lead lining is installed to maintain radiation safety protection according to regulatory requirements.
   3. All work affecting Radiation Safety Lead Barriers has been properly sealed.
   4. The overall condition of the area meets the expectation outline in the per-work inspection.

D. The Maintenance Manager and Radiation Safety Coordinator signs and logs the completed “ACWP”

PART 3 - EXCEPTIONS

A. None.

PART 4 -

4.1 PRIMARY SOURCES

A. List the regulatory references upon which the procedure is based (cite the code, the title, and the statute).

PART 5 -

5.1 SECONDARY MATERIALS

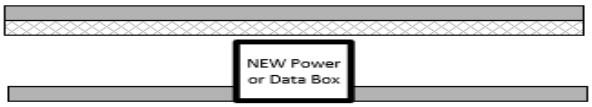
A. Radiation Safety Policy

B. Above Ceiling Work Permit

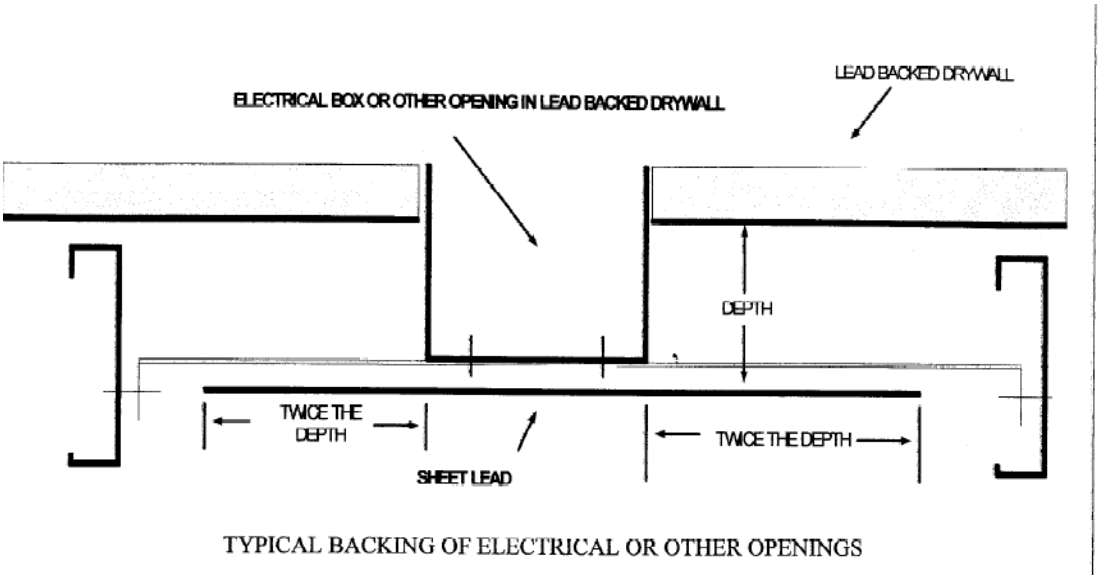
C. Lead lined wall requirements as defined by Radiation Safety Building Requirements

Option 1: worker to install new power utility wall box and add Lead Lining to wall behind box
If worker can access posterior wall entry

Option 2: worker to install new power utility wall box – box is lead Lined by manufacturer



Option 3: worker to install new power utility wall box - no additional lead lining required if installation does not disrupt the existing shielding



TYPICAL BACKING OF ELECTRICAL OR OTHER OPENINGS

END OF SECTION

Division 28 1300
ACCESS CONTROL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section, Div. 26, and Div. 27.

1.2 SUMMARY

A. This section includes a complete installation of a PC based and managed access control and security system (Lenel) and specifies sensors, signal equipment, and system controls. The Lenel system shall be capable of functioning with both standard wired locks and card readers as well as with network connected integrated hardware.

B. The electrified locking and access hardware for this project is specified using ASSA ABLOY products. Where integrated lock sets are designated, the security contractor is to provide the integrated access control connection locking devices, wire harnesses, and transfer hinge. Locking devices are specified to use either POE or standard wiring connections. Cabling for the POE locking devices shall be provided by Div 27 contractors with the security contractor providing the cabling for non-POE locking hardware.

C. The system shall also interface with wired access control for medical cabinets and refrigerators where required.

1.3 DEFINITIONS

A. Hard-Wired System: Alarm, supervisory, and detection devices are directly connected, through individual dedicated conductors, to central control panels.

1.4 SYSTEM DESCRIPTION

A. The system shall have both access-controlled doors and alarm inputs for panic buttons and intrusion detection.

B. The system shall support automatic responses to alarms entering the system. Each alarm condition shall be capable of initiating numerous events including but not limited to: Activation of remote devices, door control, remote annunciation LED's, and card validation.

C. Access control functions shall include but not be limited to: Validation based on time of day and day of week, holiday scheduling with card validation override, and access validation based on positive verification of card.

D. The system shall interface with the fire alarm system and in the event of an alarm, shall release all controlled doors designated for emergency egress, and put them in fail-safe mode allowing free egress.

1. Behavioral Health situation. Tied into closest smoke head, only release when that smoke head detects fire.

1.5 FUNCTIONAL PERFORMANCE

A. The system shall consist of a network controller and network nodes using a standard TCP/IP network. Each controller shall retain all data necessary for system operation in its own RAM. Each controller will contain an integrated real time clock that continues to govern events even if communication with the main network controller is interrupted.

B. The network controller shall act as an interface point with the node network, a database management tool, and a transaction storage device.

1.6 ACTION SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections

B. Product data for system components, including "Nationally Recognized Testing Laboratory" (NRTL) listing data and list of materials, dimensioned plans, sections, and elevations showing minimum clearances, mounting arrangements, and installed features and devices.

C. Wiring Diagrams and Door Elevations: Submit wiring diagrams and door elevations with product data in one submittal. Provide the following for each opening having electric hardware, except doors with only magnetic holder/release units.

1. Wiring diagrams for scheduled items requiring power. Identify manufacturer-installed and field-installed wiring.
2. Provide load calculations and requirements for each electro-mechanical locking device within
   +/-5% of 24 VDC. Size the conductors for each device appropriately to maintain this requirement.
3. Provide cable type (as indicated on the Shop Drawings Wire Legend) that is used for each electro-mechanical locking device, the conductor size, the estimated total length of cable, the estimated line loss (voltage drop), and the percentage of estimated line loss (voltage drop).

D. System operation description, including method of operation and supervision of each component and each type of circuit, and sequence of operations for all manually and automatically initiated system inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are not acceptable.

1.7 CLOSEOUT SUBMITTALS

A. Operation and maintenance data for inclusion in the “Operating and Maintenance Manual" specified in Division 01. Include data for each type of product, including all features and operating sequences, both automatic and manual. Include user's software data and recommendations for spare parts to be stocked at the site. Provide names, addresses, and telephone numbers of service organizations that stock repair parts for the system.

B. Product certifications signed by the manufacturers of system components certifying that their products comply with the referenced standards.

C. Separate Qualification Data for Manufacturers and Installers: Demonstrate their capabilities and experience as specified in Quality Assurance Article. Include lists of completed projects with project names and addresses, names of Contracting Officer and Government representatives, plus other information specified.

D. Provide all field tests of system.

1.8 QUALITY ASSURANCE

A. Convergint and IES are Intermountain Healthcare's approved installers. Convergint is the preferred installer as they are the only one that can sell licenses and install/program in the badge access system.

B. Comply with NFPA 70, "National Electrical Code."

C. Listing and Labeling: Provide system and components that are listed and labeled for their indicated use and location on the Project.
   1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

D. Comply with UL Standard 609, 1023, and 1076.

E. FM Compliance: Provide FM approved card access system and components.

F. Single Source Responsibility: Obtain system components from a single source (the prime system manufacturer) that assumes responsibility for system components and for their compatibility.

G. The successful bidding contractor shall be required to have training and accreditation with both ASSA ABLOY and Lenel.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of card readers, sensors, equipment related to access control operation, etc., that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: One year from date of Substantial Completion.

1.10 COORDINATION

A. Access Control System Electrical Coordination: Coordinate with the layout and installation of scheduled electrified door hardware, and related access control equipment, with required connections to source power junction boxes, power supplies, detection and monitoring hardware and fire alarm system.
   1. Door Hardware Interface: The card access control system shall be connected to electronic door control hardware (electromechanical

locks, electric strikes, magnetic locks, Request to Exit device, door position switches, other monitoring contacts, and related auxiliary control devices) as described under Division 8 "Door Hardware". Coordinate with the installation and configuration of specified door hardware being monitored or controlled with the controls, software and access control hardware specified in this Section.

2. Access Control Hardware Sets: The hardware sets listed represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality. Refer to Section 087100 Door Hardware Schedule for hardware set information.

3. Fire Alarm Interface: Review Door Hardware Schedule for sequence of operation requiring an interface with the fire alarm system, such as release upon fire alarm. Coordinate with the fire alarm installer to provide all fire alarm system components to accomplish the specified sequence of operation. Provide fire alarm release at all delayed egress doors and any other doors in the path of egress that are allowed to be locked.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Lenel

B. At facilities that already have an approved card access system, using the same card access system as what is already present is permitted. If a replacement of the current system is required, the replacing system must be Lenel.

2.2 ACCESS CONTROL SYSTEM EQUIPMENT, GENERAL

A. Surge Protection: Comply with the minimum requirements of UL Standard 1449, "Transient Voltage Surge Suppressors," for each component using solid state devices and having a line voltage power source connection or an exterior underground signal connection.

B. Provide at the locations identified, a complete and operational Access Control and Security System including but not limited to the following equipment:
   1. Card Readers
   2. Door Logic Panels
   3. Relay output contacts
   4. All power supplies and/or transformers
   5. All equipment, security devices, components, wire, cable, and mounting hardware as required to meet specification requirements and manufacturers documented installation procedures.

C. Provide the quantity of new door licenses to the existing Lenel building package to accommodate the increased number of readers being added as part of this project.

2.3 PHYSICAL SECURITY APPLIANCE

A. Physical Security Appliance (PSA): Stand-alone, modular multi-reader access controllers shall be provided for standard door opening access control. The appliances shall communicate to the main system server using Ethernet TCP/IP and shall serve as the data collection and communications interface between the system server and the various field devices such as card readers, alarm inputs and control outputs.

B. Power Requirements: Each Physical Security Appliance (PSA) shall accept a power input voltage of 120 VAC, 60Hz. Maximum power draw shall be no more than 300W. The PSA shall generate appropriate DC voltage levels for on-board use as required. External lock power supplies shall be required and sized for the appropriate number of locks (plus 20%) associated with each fused distributed controller. All power outputs to external devices shall be currently limited in accordance with class 2 power limited wiring standards

C. Battery Backup: The power supplies inherent in the PSA shall have the capability of charging standard gel-cell batteries and shall be capable of operating on direct battery backup. The PSA shall be capable of providing at least eight hours of full operation backup time and shall be capable of recharging its batteries in less than 48 hours. Batteries shall be mounted in a separate, dedicated battery shelf sized to contain the number of batteries required.

D. Access Control System
   1. Lenel OnGuard. Contractor to include appropriate OnGuard licensing to accommodate additional reader devices

E. Mercury Control Board
   1. Lenel X2220 or M2220 – ICS Intelligent System Controller
   2. Lenel 1320S3 – Dual door controller
   3. Lenel 1100S3 – Input board
   4. Lenel 1200S3 – Output board

F. Control Board Enclosure
   1. Life Safety FPO150/250-2D82M8NL4E8M2 (16 Doors)
   2. Life Safety FPO150-B100 D8M8NL4E4M1 (8 Doors)

2.4 ELECTRICAL POWER

A. Normal System Power Supply: 120 V 60 Hz from locked disconnect device. System components are supplied with power through separate power supplies. Provide all required power supplies and associated transformers as specified by the manufacturer. NetLink7 boards shall be present on all power supplies and connected to the Intermountain network via a cable specified by Div 27-Section 271513-1.

B. Power Source Transfer: When normal power is interrupted, the system is automatically switched to a backup supply without degradation of critical system function or loss of signals or status data.
   1. Backup Source: Batteries in power supplies of individual system components. Such batteries are an integral part of power supplies of the components.
   2. Annunciation: Switching of the system or any system component to backup power is indicated as a change in system condition.

2.5 CARD ACCESS SYSTEM HARDWARE, GENERAL

A. Types, features, accessories, and mounting conditions of individual devices are as indicated.

B. Battery Backup: The access control panel shall be provided with back up battery power for eight hours operation upon loss of AC power.

C. Suppression: The access control panel shall have provisions for relay suppressor kits for each relay used, to protect the access control panel from collapsing electrical fields.

D. Card Readers (SEOS Technology)
   1. Behavioral Health Spaces: Card readers shall be Essex iRox Pro+ multiclass SE readers.
      a. Proximity Readers: The system shall be provided with uni-directional proximity card readers. The standard multi-class SE readers shall have a read range of five to eight inches. The reader shall be able to be mounted with its sides against metal door, window frames, and/or masonry walls. Provide tamper resistant TORX screws.
      b. Reader protocol shall be Weigand or OSDP (where adding to existing protocol to match).
      c. Proximity PIN Code Readers: All badge readers placed on doors leaving a secured behavioral health unit will have included a PIN code. PIN code badge readers will include a ligature-resistant bevel around the exposed hardware
      d. Standard readers: IRXPO-2-S-LRB
      e. PIN Code readers: PiezoProx PPH - 103

   2. Non-Behavioral Health Spaces: Card readers shall be HID Signo readers.
      a. Proximity Readers: The system shall be provided with uni-directional proximity card readers. The standard HID Signo readers shall have a read range of five to eight inches. The reader shall be able to mount with its sides against metal door, window frames, and/or masonry walls. Long range readers mounted at vehicle gates shall have a minimum 10 inch read range.
      a. Reader protocol shall be Weigand or OSDP (where adding to existing protocol to match).
      b. Standard readers: HID SIGNO 40TKS-00-000000-HD01
      c. PIN Code readers: HID SIGNO 40KTKS-00-000000
      d. Mullion Installation: HID 20NKS-00-000000 Signo 20
      e. Mullion Pin Code: HID 20KNKS-00-000000

2. Integrated Access Control Reader
   a. Wireless (Must be reviewed by a member of the Security Systems Engineering Team prior to bid)

      1) Sargent Manufacturing (SA) – IN100 Series
      2) Corbin Russwin (RU) – IN100 Series (Security Systems Engineering Team must be consulted prior to use)
      3) No-Sub
   b. Wired

      1) Sargent Manufacturer (SA) – SN210 Series OSDP (on new build projects only)
      2) Corbin Russwin (RU) – SN 210 Series OSDP (on new build projects only)
      3) No-Sub

3. Electric Strike
   a. HES (HS) – 1006CS Series
   b. HES (HS) – 1500C Series
   c. HES (HS) – 5200C Series
   d. HES (HS) – 9400 Series
   e. HES 9100/9200 (Glass locking hardware)

4. Delayed Egress Maglock
   a. Securitron DE/M680E
   b. RCI 8310 x DSS/SCS

5. Request to Exit
   a. Bosch DS160

6. Door Position Switch
   a. Securitron (SU) DPS-W/M
   b. GRI 8080 (DPS w/o Intrusion)
   c. GRI 195-12-B

7. Power Transfer
   a. Pemko (PE) – EL-CEPT Series
   b. Securitron (SU) – EL-CEPT Series
   c. Von Duprin (VD) – EP-10

8. Med Cabinet Locking Hardware (must include key override and be hard-wired to controller)
   a. HES 660-12-LBSM
   b. HES 660-KO
   c. Signo Mullion – 20TKS-00-000000
   d. MED600650T-KIT-W-26-QJ-S

9. Data Rack
   a. HES KS210 (hardwired to controller) OSDP (on new build projects only)

10. Refrigerator Locking Hardware (controlled by traditional card reader hardwired to controller)
    a. HES 660-12-LBSM

2.2 POWER SUPPLIES

A. Provide power supplies as per manufacturers written recommendations with total number of powered devices for each power supply restricted to only consuming 75 percent of the power supplies rated amperage. Provide separate power supplies for system controllers (As per manufacturer), card readers (12VDC, 5 A), and locks (24 VDC, 7 A).

2.3 CONTACT INDICATOR SWITCHES

A. Contact indicators on overhead doors that are not supplied by the door manufacturer shall be Edwards Signaling series 2300 type surface mounted magnetic reed type switches with opposing magnet and shall be per manufacturer's recommendations for the type of door.

2.4 WIRE AND CABLE

A. Cables: Bundled, shielded, twisted-pair cable, shielded where manufacturer recommends shielded cable for standard readers and locking hardware. Networking cable shall conform to what is specified in Div 27 – Section 271513-1.

1. Specified Manufacturer: Provide the specified product or prior approved equal.
   a. Windy City Wire, Part Number 4461030.
   b. Coleman Cable Inc. (CCI) Part Number 73101 consisting of the following cables bundled plenum rated within a yellow Low Smoke PVC, CMP/CL3P/FPLP jacket:

      1) PN 72321: 22 AWG 2/Conductor CMP. Typical use, Door Contact
      2) PN 72344: 22 AWG 4/Conductor CMP. Typical use, Request to Exit/Spare
      3) PN 75366: 22 AWG 6/Conductor shielded CMP. Typical use, Card Reader.
      4) PN 71944: 18 AWG 4/Conductor CMP. Typical use, Lock Power
   c. Any of the above cables may be used individually where cables in addition to those included in the bundle are required.

B. Comply with Division 26 Section "Wires and Cables" except as indicated.

C. Cable for Low Voltage Control and Signal Circuits: Shielded twisted pair cable with drain. Comply with Division 26 Section "Wires and Cables."

2.5 RACEWAY

A. Comply with Division 27 Section 270363.5 D.

2.6 DOOR HARDWARE SCHEDULE

A. Refer to Section 087100 Door Hardware Schedule for hardware set information and assignment of required components to be provided by the Division 28 contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables in accordance with Div. 27, Section 27036 – 3.3 – C. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with TIA/EIA 606-A, "Administration Standard for Commercial Telecommunications Infrastructure."

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.

1. For each location, record setup of controller features and access requirements.
2. Prepare a specific plan for system testing, startup, and demonstration.
3. Develop acceptance test concept and, on approval, develop specifics of the test.
4. Develop cable and asset-management system details, input data from construction documents.

3.3 INSTALLATION

A. General: Install system according to NFPA 70, Div 27 270536 – 3.5-D, applicable codes, and manufacturer's printed instructions.

B. Intermountain Healthcare Approved Installers:
1. Convergint
2. Robert I Merril (exclusively for Napco Continental, when Continental is already present)
3. IES
4. Telnet (Montana)

C. Wiring Method:
1. Concealed in walls or above inaccessible ceilings: Install all cabling in raceways, 1inch minimum. Conduit fill shall not exceed 40%.
2. Above Accessible Ceilings: Provide J-Hooks at not more than 5 feet on center. Fasten J-Hooks to walls with solid anchoring to studs. Where wall is unavailable, suspend from structure using not less than 3/8” diameter threaded rod.
3. Exposed: Install cables in minimum 1” electrical metallic tubing (EMT) conduit with straps and not more than within 3 feet of each termination (boxes or panels) and at intervals not to exceeding 10 feet along the run.
4. Exposed Environmental: Install exposed cables in minimum 3/4” galvanized rigid metal conduit with straps at not more than 3 feet on

center and minimum 1/4" gap between conduit and building surface. Use boxes that are specified for surface mounting.

D. Wiring within Panels and Enclosures: Bundle, wrap, and train the conductors to terminal points with 6-inches of slack minimum, 12-inches of slack maximum. Provide and use cable management hardware and distribution spools.

E. Number of Conductors: As recommended by system manufacturer for functions indicated. As a minimum install one bundled, shielded and unshielded, twisted pair cable for every access-controlled door.

F. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull and outlet boxes, terminal cabinets, and equipment enclosures. The use of B-connectors or beanies is not permitted.

G. Tighten connections to comply with tightening torques specified in UL Standard 486A.

H. Identification of Conductors and Cables: Conductors and cables shall be identified at both ends with permanent, legible, thermal transfer PermaSleeve marking labels. These markings, along with conductor color-coding, must correspond directly to the system wiring diagrams to ensure accurate identification.

I. Install power supplies and other auxiliary components for detection devices at the door controller panel or at a data gathering panel except as otherwise indicated. Do not install such items in the vicinity of the devices they serve.

3.4 GROUNDING

A. Comply with Section 280526 "Grounding and Bonding for Electronic Safety and Security."

B. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Bond shields and drain conductors to ground at only one point in each circuit.

3.5 DOOR RELEASE BUTTON INSTALLATION

A. Pushbuttons: Pushbutton switches shall be connected to the controller associated with the portal to which they are applied, and shall operate the appropriate electric strike, electric lock, or other facility release device. The system shall also use card readers in place of pushbuttons at designated locations for remote operation of access-controlled doors.

B. Locations: Pushbutton locations are required to be at (but not limited to) all registration desks/workstations. Button function shall be programmed by the badge access integrator.

C. For standalone clinic areas, a toggle switch shall be installed for controlling the card-access system for lock/unlocking the door in lieu of a momentary door release button. Programming of toggle switch to be conducted by badge access integrator.

3.6 Panic Button Installation

A. Panic buttons shall be wired from the location of the mounted button to the Physical Security Appliance (PSA). Wireless options may only be used in extreme situations that must be reviewed by the Security Systems Engineer for the facility. If wireless option is used, the physical button must be powered by onsite electricity and not by battery.

B. Locations: Panic Buttons are required to be at (but not limited to) all registration desks/workstations, nurses station, welcome desks, behavioral health consultation/counseling rooms, any location money is counted or exchanged, and pharmacies.

C. Hardware: Honeywell 269R is the preferred hardware

3.7 IDENTIFICATION

A. In addition to requirements in this article, comply with applicable requirements in Section 260553 "Identification for Electrical Systems" and with TIA/EIA 606-A.

B. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown. Conductors and cables shall be identified with permanent, legible, thermal transfer Perma Sleeve marking labels. These markings, along with conductor color-coding, must correspond directly to the system wiring diagrams to ensure accurate identification.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.
3. The label of each badge reader and panic button where installed as designated by the Security Systems Engineer for the facility.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory authorized service representative to supervise the field assembly and connection of components and system pre-testing, testing, adjustment, and programming.

B. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

C. Pre-testing: Align and adjust the system and perform pre-testing of all components, wiring, and functions to verify conformance with specified requirements. Correct deficiencies by replacing malfunctioning or

damaged items with new items. Retest until satisfactory performance and conditions are achieved.

D. Testing: Provide at least 10 days' notice of acceptance test performance schedule.

E. Operational Tests: Perform operational system tests to verify conformance with specifications. Test all modes of system operation and intrusion detection. Methodically test for false alarms in each zone of space intrusion detection devices by simulating activities outside indicated detection patterns.

F. Installer Start-up Responsibility: The Installer shall initiate system operation. The Installer shall provide competent start up personnel on each consecutive working day until the system is fully functional. Upon reoccurring technical problems, the Installer shall supply the factory-direct Manufacturer's support in the form of factory technical representation and/or diagnostic equipment until the resolution of those defined problems.

3.9 ADJUSTMENT

A. Occupancy Adjustments: When requested within 1 year of date of substantial completion, provide onsite assistance in adjusting and reprogramming to suit actual occupied conditions.

3.10 DEMONSTRATION

A. Train owner's operating personnel (a member of the Security Systems Engineering Team) in the programming and operation of the system. Train owner's maintenance personnel in the procedures and schedules involved in preventive maintenance and in operating, adjusting, troubleshooting, and servicing of the system. Provide a minimum of 4 hours training.

B. Schedule training with advance notice of at least 7 days.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 282300
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SUMMARY

A. The selection includes a video surveillance system consisting of cameras, software installation, configuration, and licensing. Network electronics shall be provided by the Owner. Pulling cable, and terminations shall be provided by Div 27 276007.

B. Owner approved integrator:
   1. CONVERGINT TECHNOLOGIES.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance, submit shop drawings with product data in one submittal. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
   3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
   4. Wiring Diagrams: For power, signal, and control wiring.
   5. Sample systems detail report consisting of camera ID, TDR location, camera model, network switch id, patch panel port number, network switch port number, ip address, and PoE requirements.

C. Equipment List: Include every piece of equipment by model number, manufacturer, location, and date of original installation.

D. Field quality-control reports.

E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NECA 1.

C. Comply with NFPA 70.

D. Electronic data exchange between the video surveillance system with an access-control system shall comply with SIA TVAC.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Video-signal formats shall comply with IP based digital transmission.

B. Surge Protection: Protect components from voltage surges entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.

1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits." as recommended by manufacturer for type of line being protected.

C. Tamper Protection: Tamper protection capability shall be provided as part of the camera manufacture and design.

2.2 CAMERAS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AXIS
2. BOSCH (following approval by Security Systems Engineer)

B. Description: Camera shall be an all-in-one solution with integrated megapixel camera, varifocal lens, and dome enclosure. Refer to the camera type schedule in the drawings.

C. Model Types

1. Multi-lens camera models shall be used at intersections containing 3 or more hallways
2. Dual-lens camera models shall be installed in the center of hallways that are 35ft or greater.
3. Multi-lens camera models shall be installed on exterior corners of the facility and be corner-mounted or parapet mount for structures 2 stories and below.
4. Multi-lens camera models shall be installed on exterior light poles.

5. Anti-ligature cameras models shall be corner mounted in rooms designated as: seclusion rooms, seclusion ANTE rooms, sensory rooms, time out rooms, and quiet rooms.
6. 12mp panoramic “fisheye” camera models shall be installed in pharmacies and over medication dispensing machines.

D. All camera models and place must be reviewed by the Security Systems Engineer over the facility.

2.3 CAMERA-SUPPORTING EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AXIS
2. BOSCH (following approval by Security Systems Engineer)

B. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.

C. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.

D. Protective Housings for Fixed Cameras: Dome type enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed. Dome enclosures mounted outside shall be manufactured with environmental features for sustained function in all expected temperatures.

E. The installer shall provide CAT6A patch cables to connect the camera to the network cable ran from the data closet. Installer shall connect the patch cable from the camera to the network cable.

2.4 IP VIDEO MANAGEMENT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Genetec

B. Description:
1. The system shall provide high-quality delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.
2. The system shall have seamless integration of all video surveillance and control functions.
3. The system design shall include all necessary compression software for high-performance, dual-stream, MPEG-2/MPEG-4/h.264 video. The unit shall provide connections for all video cameras, camera PTZ control data, bidirectional audio, discreet sensor inputs, and control system outputs.
4. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.

5. All system interconnect cables, camera licenses, workstation programming, and other system intermediate devices shall be provided for the full performance of specified system.

C. The viewing of security cameras shall be done over the Intermountain network via:
1. Use of software installed on Intermountain computer hardware
2. Axis PoE video decoder, displayed on a monitor
3. Eizo decoding monitor

2.5 SIGNAL AND POWER TRANSMISSION COMPONENTS

A. Cable: Refer to Div 27 – Section 271513-1.

B. Camera Power: POE-enabled network switches. (By Owner)

C. Media Converter (Camera Fiber Connections): 10/100/1000 Media converter with Power over Ethernet. Provide OmniConverter GPoE+ by Omnitron systems or approved equal. (BA2)

PART 3 - EXECUTION

3.1 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Intermountain Healthcare Approved Installers:
1. Convergint

B. Install cameras at heights noted in drawings.

C. Set pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms and adjust.

D. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
a. Verify operation of auto-iris lenses.

b. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
c. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
d. Set sensitivity of motion detection.
e. Connect and verify responses to alarms.
f. Verify operation of control-station equipment.

3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation.
5. Complete system detail report and provide with as built and O&M documentation.

C. Video surveillance system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 INTERCOM ENTRY SYSTEMS

A. Summary
1. Digital audio-video inter entry system.

B. Warranty
1. Special Installer Warranty: Installer warrants that fabricated and installed intercom entry system perform in accordance with specified requirements and agree to repair or replace components or products that fail to perform as specified within the warranty period.
a. Warranty Period: one year from date of substantial completion; full coverage for labor, materials, and equipment.

C. Product
1. Axis I8 intercom products.

D. Installation
1. Comply with manufacturers' published instruction.

E. Interface with Other Work
1. Coordinate installation of new products for intercom entry system with existing conditions.
2. Coordinate with Section 281300 "Access Control" for physical and functional interfaces with access control system and for compliance with system-wide performance requirements.

F. Field Quality Control
1. Field tests and inspection must be witnessed by Security Systems Engineer or approved Intermountain Health representative.
2. System will be considered defective if it does not pass tests and inspections.

3. Remove and replace defective system and retest replacement unit.

3.4 DEMONSTRATION

A. Train owner's operating personnel (a member of the Security Systems Engineering Team) to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION

SECTION 282400
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Non system smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Firefighters' two-way telephone communication service.
8. Magnetic door holders.
9. Remote annunciator.
10. Addressable interface device.
11. Digital alarm communicator transmitter.
12. Radio alarm transmitter.
13. System printer.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified FMG-placarded addressable system, with automatic sensitivity control of smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire-alarm system, submit shop drawings with product data in one submittal. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include fire alarm zoning diagrams indicating zoning of the fire alarm system coordinated with the corresponding fire protection zones and smoke compartments. Comply with NFPA 99.
4. Include battery-size calculations.
5. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

6. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations. Provide remote test switches (RTS) as required by NFPA 72.
7. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
8. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
   a. Trained and certified by manufacturer in fire-alarm system design.
   b. NICET-certified fire-alarm technician, Level III minimum.
   c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.

6. Abbreviated operating instructions for mounting at fire-alarm control unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamper proofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

1.10 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.

H. NFPA Certification: Obtain certification according to NFPA 72 by the Authority Having Jurisdiction.

1.11 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under

the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Construction Manager no fewer than 7 days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Construction Manager's written permission.

1.12 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.13 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
   1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide product by the following:
   1. Notifier (Match Existing)

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices[and systems]:
   1. Manual stations.
   2. Smoke detectors.
   3. Duct smoke detectors.
   4. Verified automatic alarm operation of smoke detectors.
   5. Automatic sprinkler system water flow.
   6. Heat detectors in elevator shaft and pit.
   7. Fire-extinguishing system operation.
   8. Fire standpipe system.

B. Fire-alarm signal shall initiate the following actions:
   1. In the Clinic and Central Utility Plant (CUP), continuously operate alarm notification appliances.
   2. In the hospital, continuously operate chime/strobe appliances in smoke zone where alarm is initiated. Continuously operate strobe appliances throughout the hospital
   3. Identify alarm at fire-alarm control unit and remote annunciators.
   4. Transmit an alarm signal to the remote alarm receiving station.
   5. Unlock electric door locks in designated egress paths.
   6. Release fire and smoke doors held open by magnetic door holders.
   7. Activate voice/alarm communication system.
   8. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
   9. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
   10. Activate stairwell and elevator-shaft pressurization systems.
   11. Close smoke dampers in air ducts of designated air-conditioning duct systems.

12. Recall elevators to primary or alternate recall floors.
13. Activate emergency lighting control.
14. Activate emergency shutoffs for gas and fuel supplies.
15. Record events in the system memory.
16. Record events by the system printer.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.
3. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on a system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
   a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   b. Include a real-time clock for time annotation of events on the event recorder
   c. Must be able to operate and monitor Pre-action systems throughout hospital

2. Addressable initiation devices that communicate device identity and status.
   a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
   b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:
   1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
      a. Initiating Device Circuits: Style D.
      b. Notification Appliance Circuits: Style Z.
      c. Signaling Line Circuits: Style 7.
      d. Install no more than 50 addressable devices on each signaling line circuit.

   2. Serial Interfaces: Two RS-232 ports for printers.

D. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.

1. Pressurization starts when any alarm is received at fire-alarm control unit.
2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.

E. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

F. Notification Appliance Circuit: Operation shall sound in a temporal.

G. Elevator Recall:
1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm- initiating devices, except those listed, shall not start elevator recall.
   a. Elevator lobby detectors except the lobby detector on the designated floor.
   b. Smoke detector in elevator machine room.
   c. Smoke detectors in elevator hoist way.
2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
   a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

1. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system. Review Door Hardware Schedule for sequence of operation requiring an interface with the fire alarm system, such as release upon fire alarm. Provide all fire alarm system components to accomplish the specified sequence of operation which may require components beyond those that are indicated on drawings. Provide fire alarm release at all delayed egress doors and any other doors in the path of egress that are allowed to be locked.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

J. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power- supply module rating.

L. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
   1. Batteries: Sealed, valve-regulated, recombinant lead acid.

M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
   1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
   2. Station Reset: Key- or wrench-operated switch.
   3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
   4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:
   1. Comply with UL 268; operating at 24-V dc, nominal.
   2. Detectors shall be four-wire type.
   3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
   4. Base Mounting: Detector and associated electronic components shall be mounted in a twist- lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
   5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
   6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
   7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
      a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
      b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).

c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
7. Remote Test Station (RTS): Provide keyed type RTS. Comply with NFPA 72, owner, AHJ, architect, and EOR locations.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

F. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-(25-mm-) high letters on the lens.
1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.
2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

2.8 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware. Refer back to Div 08

2.9 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall to circuit-breaker shunt trip for power shutdown.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire- alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45

seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:
   1. Verification that both telephone lines are available.
   2. Programming device.
   3. LED display.
   4. Manual test report function and manual transmission clear indication.
   5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:
   1. Address of the alarm-initiating device.
   2. Address of the supervisory signal.
   3. Address of the trouble-initiating device.
   4. Loss of ac supply or loss of power.
   5. Low battery.
   6. Abnormal test signal.
   7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 SYSTEM PRINTER

A. Printer shall be listed and labeled by an NRTL as an integral part of fire-alarm system.

2.13 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
   1. Factory fabricated and furnished by manufacturer of device.
   2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
   1. Comply with requirements for seismic-restraint devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Smoke- or Heat-Detector Spacing:
   1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
   2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
   3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
   4. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
   5. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Install keyed remote test stations in acceptable locations.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

G. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water- flow switch and valve-tamper switch that is not readily visible from normal viewing position.

H. Remote Test Station (RTS): Install keyed test station in wall near each duct smoke detector that is not readily visible from normal viewing position. Provide in locations acceptable to owner, AHJ, Architect, & EOR.

I. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

L. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

M. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.2 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceway according to Division 26 Section 260519 Conceal raceway except in unfinished spaces and as indicated.

B. Wiring for Grid Ceiling Mounted Devices: Install junction box at accessible location above ceiling. Use flexible metal conduit for wiring between junction box and outlet box for ceiling mounted device. Secure flexible conduit within 12 inches of junction box.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp- on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems. Provide end switches at each smoke and fire/smoke damper
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at elevator shunt trip breaker.
10. Supervisory connections at fire-pump power failure including a dead-phase or phase- reversal condition.
11. Supervisory connections at fire-pump engine control panel.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:
1. Visual Inspection: Conduct visual inspection prior to testing.
a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.

b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.

6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 310700

GENERAL SITE CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but Not Limited to:

1. General procedures and requirements for Site Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Site Verification of Conditions

1. 48 hours minimum prior to performing any work on site, contact Dig Line to arrange for utility location services.
2. Perform minor, investigative excavations to verify location of various existing underground facilities at sufficient locations to assure that no conflict with the proposed work exists and sufficient clearance is available to avoid damage to existing facilities.
3. Perform investigative excavating 5 days minimum in advance of performing any excavation or underground work.
4. Upon discovery of conflicts or problems with existing facilities, notify Architect by phone or fax within 24 hours. Follow telephone or fax notification with letter and diagrams indicating conflict or problem and sufficient measurements and details to evaluate problem.
5. Notify Owner of utilities a minimum of 48 hours prior to a work taking place.

3.2 PREPARATION

A. Protection

1. Spillage -

a. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways.
b. Remove spillage and sweep, wash, or otherwise clean project, streets, and highways.

2. Dust Control -

a. Take precautions necessary to prevent dust nuisance, both on-site and adjacent to public and private properties.
b. Correct or repair damage caused by dust.

3. Erosion Control -

a. Take precautions necessary to prevent erosion and transportation of soil downstream, to adjacent properties, and into on-site or off-site drainage systems.
b. Develop, install, and maintain an erosion control plan if required by law.
c. Repair and correct damage caused by erosion.

4. Existing Plants and Features - Do not damage tops, trunks, and roots of existing trees and shrubs on site which are intended to remain. Do not use heavy equipment within

branch spread. Interfering branches may be removed only with permission of Architect. Do not damage other plants and features which are to remain.

5. Protect site from fire caused by welding, cutting, smoking, or other sources of ignition.

B. If specified precautions are not taken or corrections and repairs made promptly, Owner may take such steps as may be deemed necessary and deduct costs of such from monies due to Contractor. Such action or lack of action on Owner's part does not relieve Contractor from responsibility for proper protection of the Work.

3.3 REPAIR / RESTORATION

A. Adjust existing covers, boxes, and vaults to grade.

B. Replace broken or damaged covers, boxes, and vaults.

C. Independently confirm size, location, and number of covers, boxes, and vaults which require adjustment.

3.4 FIELD QUALITY CONTROL

A. Notify Architect 48 hours prior to performing excavation or fill work.

B. If work has been interrupted by weather, scheduling, or other reason, notify Architect 24 hours minimum prior to intended resumption of grading or compacting.

C. Owner reserves right to require additional testing to re-affirm suitability of completed work including compacted soils which have been exposed to adverse weather conditions.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 311000

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Protecting existing trees, shrubs, groundcovers, plants, and grass to remain.
2. Removing existing trees, shrubs, groundcovers, plants, and grass as indicated on demolition plan.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, abandoning site utilities in place, and removing site utilities.
7. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.
2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security, protection facilities, and temporary erosion and sedimentation control procedures.
3. Division 01 Section "Temporary Tree and Plant Protection" for protecting trees remaining on-site that are affected by site operations.
4. Division 01 Section "Execution" for verifying utility locations and for recording field measurements.
5. Division 02 Section "Structure Demolition" for demolition of buildings, structures, and site improvements.
6. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
7. Division 23 Section "Turf, Grasses, and Plants" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control Drawings, a sediment and erosion control plan, specific to the site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
3. Coat cut faces of roots more than 1-1/2 inches in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

3.4 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

E. Removal of underground utilities is included in Division 21, Division 22, Division 26, Division 27, and Division 28 Sections covering site utilities.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Remove tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within tree protection zones.
3. Dispose of excess topsoil as specified for waste material disposal.
4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction. Refer to project plans for improvements to be abandoned in place.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

B. Disposal: Relocate surplus soil material and unsuitable topsoil on the Owner's property in a location that has been coordinated with and approved by the owner.

END OF SECTION

PAGE INTENTIONALLY LEFT BLANK

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 312000

EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to the Geotechnical Engineering Study titled “Proposed Utah Valley Sports Performance Project” prepared by CMT Technical Services, dated July 2, 2026, CMT Project No. 105485 for additional grading requirements.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing sub-grades for slabs on grade, walks, pavements, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling for utility trenches.
8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Division 01 Section "Allowances" for quantity allowance provisions related to unit-price rock excavation and authorized additional excavation.
2. Division 01 Section "Unit Prices" for unit-price rock excavation and authorized additional excavation provisions.
3. Division 01 Section Construction Progress Documentation and Photographic Documentation for recording pre-excavation and earthwork progress.
4. Division 01 Section “Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
5. Division 01 Section "Temporary Tree and Plant Protection" for protecting and trimming trees to remain.
6. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
7. Divisions 21, 22, 23, 26, 27, and 28 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
8. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above-grade and below-grade improvements and utilities.
9. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
10. Division 31 Section "Drilled Concrete Piers and Shafts" for excavation of shafts and disposal of surplus excavated material. (Not Used)
11. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.

12. Division 32 Section "Plants" for planting bed establishment and tree and shrub pit excavation and planting.
13. Division 33 Section "Sub-drainage" for drainage of foundations, slabs on grade, walls, and landscaped areas.

1.3 UNIT PRICE

A. Unit prices for earthwork are included in Division 01 Section "Unit Prices."

B. Quantity allowances for earthwork are included in Division 01 Section "Allowances."

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the work.
2. Bulk Excavation: Excavation more than 10-feet in width and more than 30-feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, un-stratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cubic yard for bulk excavation or 3/4 cubic yard for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090-lbf and stick-crowd force of not less than 18,650-lbf; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Each type of plastic warning tape.
2. Geotextile.
3. Controlled low-strength material, including design mixture.

B. Samples: 12-by-12-inch Sample of sub-drainage and other geotextiles used.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D698 or ASTM D1557 for each on-site and borrow soil material proposed for fill and backfill.

D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.6 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review location and installation of shoring prior to excavation within 20 feet of existing buildings.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Well Graded, ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM or AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 3-inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Native rock crushed to meet the above requirements and free from significant porosity may also be used as satisfactory soils.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
2. Unsatisfactory soils also include satisfactory soils not well graded.

D. Subbase (Non-Structural Fill) Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with a maximum particle size of 6 inches, at least 90 percent passing a 2-inch sieve and not more than 35 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 3/4-inch sieve and not more than 11 percent passing a No. 200 sieve and meeting the following gradation limits:

1. Gradation Table Base Course:

1”	100%
½”	79-91%
#4	49-61%
#16	27-35%
#200	7-11%

F. Engineered (Structural) Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with a maximum particle size of 4”. at least 70 percent passing a 3/4-inch sieve, a maximum 20 percent passing the No. 200 sieve and a maximum Plasticity Index of 10.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 3/4-inch sieve and not more than 8 percent passing a No. 200 sieve and meeting the following gradation limits.

1. Gradation Table Bedding Course:

¾”	100%
3/8”	78-92%
#4	55-67%
#16	28-38%
#200	4-8%

H. Drainage Course: Narrowly graded mixture of washed or crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Non-woven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:

1. Portland Cement: ASTM C 150, Type II.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch to 3/8-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce low-density, controlled low-strength material with the following physical properties:

1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. at point of placement, when tested according to ASTM C 138/C 138M.
2. Compressive Strength: 80 psi, when tested according to ASTM C 495.

2.4 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows when required by utility purveyor:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons or vehicle with similar unit axel weight.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, sub-drainage, damp proofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with subbase material as described above; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

D. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 12 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of subbase material or satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.

G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use subbase material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 12-inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Reduce loose depths as needed to achieve required compactions.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 or ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and re-compact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under lawn or unpaved areas, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent if in landscaping areas or 95 percent if under structures, pavements, or walks.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus, or minus 1 inch.
2. Walks: Plus, or minus 1 inch
3. Pavements: Plus, or minus 1/2 inch

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Division 33 Section "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor].
2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.17 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends where called for on details and on plans.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase and base course to required crown elevations and cross-slope grades.
4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557.

C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698 or ASTM D 1557 where called for on project plans.

3.18 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

B. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 313116
TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes soil treatment for termite control including supplementary Work necessary for its installation.

1.2 DEFINITIONS

A. EPA: Environmental Protection Agency.

B. PCO: Pest control operator.

1.3 ACTION SUBMITTALS

A. Product Data: Treatments and application instructions, including EPA-Registered Label.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

C. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 WARRANTY

A. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

B. Warranty Period: Five years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Continuing Service: Provide a proposal for continuing service, including monitoring, inspection, and retreatment for occurrences of termite activity, from applicator to Owner, in the form of a standard yearly (or other period) continuing service agreement, starting on the date of Substantial Completion. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earth moving, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected. Starting of Work will be construed as installers acceptance of installation conditions.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLYING SOIL TREATMENT

A. General: Apply soil treatment under all enclosed structures. Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

B. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

C. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

D. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

E. Crawlspaces: Soil under and adjacent to foundations as previously indicated.

F. Adjacent Areas: Around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.

G. Penetrations: At expansion joints, control joints, and area where slabs will be penetrated.

H. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

I. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

J. Post warning signs in areas of application.

K. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 315000

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Sections:

1. Division 01 Section "Construction Progress Documentation and Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
3. Division 31 Section "Dewatering" for dewatering system for excavations. (NOT USED)

1.3 PERFORMANCE REQUIREMENTS

A. Design**,** furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls, existing buildings to remain, existing footings and foundations, and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Monitor vibrations, settlements, and movements.
5. Coordinate excavation limits with utility replacement, existing utilities to remain, historical trees and other vegetation to remain, and existing buildings to remain.

1.4 SUBMITTALS

A. Shop Drawings: For excavation support and protection system showing limits of excavation, utilities to be removed and relocated, adjacent structures, and historical trees.

B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Coordinate first paragraph below with qualification requirements in Division 01 Section "Quality Requirements. “Qualification Data: For qualified professional engineer.

D. Other Informational Submittals:

1. Photographs or Videotape: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.
2. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.

a. Note locations and capping depth of wells and well points.

1.5 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site.

1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:

a. Geotechnical report.
b. Existing utilities and subsurface conditions.
c. Proposed excavations.
d. Proposed equipment.
e. Monitoring of excavation support and protection system.
f. Working area location and stability.
g. Coordination with waterproofing.
h. Abandonment or removal of excavation support and protection system.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Architect's, Construction Manager's, and Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

1. Corners: Site-fabricated mechanical interlock or Roll-formed corner shape with continuous interlock.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

E. Shotcrete: Comply with Division 03 Section "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.

F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

H. Tiebacks: Steel bars, ASTM A 722/A 722M.

I. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless

otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

A. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

3.5 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary, to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.
2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving."
3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 320118

TYPE II (FULL-DEPTH) ASPHALT PATCH

PART 1 - GENERAL

1.1 SPECIFICATION SECTION CONFORMANCE

A. This specification section conforms to Intermountain Healthcare standards.

1.2 SECTION INCLUDES

A. Remove and replace soft spots in the existing pavement and/or areas where damaged pavement sections become evident following rotomilling activities, as directed by the Engineer, by saw cutting around the area, removing the damaged asphalt, replacing the base if necessary, and relaying hot mix asphalt.

B. Use care in removing Islands so as not to damage underlying pavement. All cost associated with repairing damage caused by the contractor during removal of Islands will be the responsibility of the contractor.

1.3 RELATED SECTIONS

A. Section 312000: Base Course

B. Section 321205: Hot Mix Asphalt Pavement

C. APWA Standard Plans, Latest Ed.

PART 2 - PRODUCTS

2.1 BASE COURSE

A. Refer to Section 312000

2.2 HOT MIX ASPHALT

A. Use hot mix asphalt meeting Section 321205 for mix design and material requirements.

2.3 TACK COAT

A. Use tack coat meeting APWA Section 321213.13; diluted 2 parts concentrate to 1 part water.

PART 3 - EXECUTION

3.1 REMOVE DETERIORATED ASPHALT SURFACING

A. Saw cut, full-depth, around the damaged area in a rectangular shape. Locate cut at least 12” beyond the visible limits of the distressed area, or as marked by the Engineer, or to a minimum patch width of 3’ in all directions.

B. Remove the damaged asphalt surfacing without damaging the surrounding asphalt pavement.

3.2 BASE COURSE REQUIREMENTS FOR TYPE II REPAIR

A. Excavate and remove existing base course to 10 inches below final pavement surface. Install 6 inches new base course that conforms to Section 312000.

B. Compact existing subgrade.

1. Use the largest piece of vibratory or impact compaction equipment possible.
2. Control compaction using a nuclear density gauge.

3. Continue compaction until additional work does not improve the measured density or until measured density reaches 95% of maximum laboratory density. AASHTO T-180.

C. Grade and compact the new base course surface.

1. Use the largest piece of vibratory or impact compaction equipment possible.
2. Control compaction using a nuclear density gauge.
3. Continue compaction until additional work does not improve the measured density or until measured density reaches 95% of maximum laboratory density. AASHTO T-180.

3.3 PLACE AND COMPACT NEW BITUMINOUS PAVEMENT MIX

A. Apply tack coat to existing sawcut surfaces at a rate of 0.08 to 0.10 gallons per square yard.

B. Place and compact 4 inches of bituminous pavement mix that conforms to Section 321205.

1. Compact material to average of 93%, minimum, of the maximum laboratory density, with no test below 90%.
2. Control compaction using a nuclear density gauge. Perform a minimum of 1 density determination (average of two 60-second readings at 90º or 180º offset) for every 100 SF, or portion thereof, of patch.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 321205

HOT MIX ASPHALT PAVEMENT

PART 1 - GENERAL

1.1 SPECIFICATION SECTION CONFORMANCE

A. This specification section conforms to Intermountain Healthcare standards.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 01 Specification Sections, apply to this Section.

B. APWA Manual of Standard Specifications, Latest Ed.

C. UDOT Standard Specifications for Road and Bridge Construction, Latest Ed.

1.3 SUMMARY

A. Section Includes:

1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Asphalt surface treatments.
6. Pavement-marking paint.

B. Related Sections:

1. Division 02 Section "Structure Demolition" for demolition, removal, and recycling of existing asphalt pavements, and for geotextiles that are not embedded within courses of asphalt paving.
2. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Division 32 Sections for other paving installed as part of crosswalks in asphalt pavement areas.
4. Division 32 Section "Pavement Crack Repair" for joint sealants and fillers at paving terminations.

1.4 UNIT PRICES

A. Work of this Section is affected by unit prices and as defined in Division 1.

1.5 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
2. Job-Mix Designs: For each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each paving fabric, 12 by 12 inches minimum.
2. Each type and color of preformed traffic-calming device.
3. Each pattern and color of imprinted asphalt and precut marking material.

D. Qualification Data: For qualified manufacturer and Installer.

E. Material Certificates: For each paving material, from manufacturer.

F. Material Quality Control Test Reports:

1. Testing Report: Submit Quality Control data to the Engineer within 1 working day after completion of each day of paving.
2. Plant Production Report: Submit daily plant production records to the Engineer within 1 working day after completion of each day of paving.

G. Fire Marshal Approval: For the striping plan, as it relates to fire lanes and the marking thereof.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide copy of manufactures experience for verification of qualifications.

1. Asphalt Binder Supplier: Use a UDOT Binder QMP 509 certified asphalt binder supplier.
2. Asphalt Mix Supplier: Use a UDOT HMA QMP 514 certified asphalt mix supplier.
3. Installer Qualifications: Imprinted-asphalt manufacturer's authorized installer who is trained and approved for installation of imprinted asphalt required for this Project.
4. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
5. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of city and DOT for asphalt paving work.
6. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
7. Preinstallation Conference: Conduct conference at Project site
8. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

B. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.

C. Review condition of subgrade and preparatory work.

D. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

E. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of

material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60 deg F.
2. Prime Coat: Minimum surface temperature of 40 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
5. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of *40* deg F for oil-based materials *55* deg F for water-based materials, and not exceeding *95* deg F.
6. Imprinted Asphalt Paving: Proceed with coating imprinted pavement only when air temperature is at least 50 deg F and rising and will not drop below *50* deg F within 8 hours of coating application. Proceed only if no precipitation is expected within two hours after applying the final layer of coating.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations. Provide project history where mix design has been used and when. Use Table 1 to determine suitability of aggregate source.

Table 1. Aggregate Physical Properties			
Property		Standard	Requirement
Coarse Aggregate			
Angularity, percent, minimum	One Fractured face	D 5821	90
	Two Fractured faces		85
Wear (hardness or toughness), percent, maximum		C 131	35
Flats or elongates (3:1 length to width), percent, maximum		D 4791	20
Fine Aggregate			
Angularity (uncompacted void content), percent, minimum		T 304	40
Sand equivalent, percent, minimum		D 2419	45
Plastic limit, maximum		D 4318	0
Blended Physical Properties			
Dry-rodded Unit Weight, lb/ft^3, minimum		C 29	75 75
Weight Loss (Soundness), percent, maximum		C 88	16
Friable particles, percent, maximum		C 142	2

NOTES
(a) Course aggregate does not pass No. 4 sieve. Fine aggregate passes.
(b) Angularity by weight.
(c) Wear of aggregate may have higher values if aggregate source is known to have higher values.
(d) Sand equivalent is waived for RAP aggregate but applies to the remainder of the aggregate blend.
(e) Plastic limit, passing No. 40 sieve. Aggregate is non-plastic even when filler material is added to the aggregate.
(f) Weight loss, using sodium sulfate.
(g) Friable particles are clay lumps, shale, wood, mica, coal passing the No. 4 sieve, and other deleterious materials.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: Performance Graded Asphalt Binder (PGAB), UDOT Section 401.

1. Meet or exceed PG 58-28, except for the following.
2. Meet or exceed PG 64-22 for Garfield, Kane, San Juan and Washington counties.

B. Tack Coat: CSS-1H as per APWA 32 12 13.13, diluted 2 parts concentrate to 1 part water.

C. Prime Coat: MC-70 or MC-250 as per APWA 32 12 13.19, undiluted; or CSS-1H as per APWA 32 12 13.13, diluted 2 parts concentrate to 1 part water.

D. Fog Seal: CSS-1H as per APWA 320113.50, diluted 2 parts concentrate to 1 part water.

E. Water: Potable.

F. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 ADDITIVES

A. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

B. Recycle Agent: ASTM D 4552.

C. Anti-strip Agent: Heat stable cement slurry, lime slurry, or chemical liquid.

D. RAP (Recycled Asphalt Pavement): Free of detrimental quantities of deleterious materials.

1. Allowed up to 15 percent by weight of RAP or recycled binder, whichever is lesser, with no change in specified binder grade.
2. Determine RAP binder content by chemical extraction.

2.4 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.

C. Paving Geotextile: AASHTO M 288 – Class I, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

D. Joint Sealant: As per section 320117.

E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N, Type F, and Type S; colors complying with FS n-P-1952.

1. Color: White, Yellow, Blue, and as indicated.

F. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.

1. Color: White, Yellow, Blue, and as indicated.

G. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS n-P-1952, Type II, with drying time of less than 45 minutes.

1. Color: White, Yellow, Blue, and as indicated.

H. Pavement-Marking Point: MPI #97 Latex Traffic Marking Paint.

1. Color: White, Yellow, Blue, and as indicated.

I. Glass Beads: AASHTO M 247*,* Type 1.

J. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, *4-* 1/2 inches high by 9 inches wide by 72 inches. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 20-inch minimum length.

2.5 ASPHALT MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located. Provide mix with the following characteristics:

a. Number of compaction blows each end of specimen: 50.
b. Satiability based on ASTM D5581: 1200 minimum.
c. Flow in 0.01 -inch units per ASTM D5581: 10-18.
d. Voids in mineral aggregate (VMA)

i. DM-3/4 – 14.0%, minimum
ii. DM-1/2 – 15.0%, minimum

e. Design air voids (Va): 3.5%

2. Gradation: Use DM-3/4 gradation meeting Table 2 unless otherwise specified.

Table 2. Master Grading Band limits

Sieve	Aggregate Grade		
	DM-3/4	DM-1/2	*NOTES:*
1 inch			(a) Gradation is expressed in percent passing by weight, ASTM C 136. Percentage of fines passing No. 200 sieve determined by washing, ASTM C 117.
3/4 inch	100		
1/2 inch		100	
3/8 inch	75 - 91		
No. 4	46 - 62	60 – 80	
No. 8			(b) The alpha portion of the grade designator (DM, OM, FM) represents dense mix, open mix and friction mix. The numerical portion (3/4, 1/2) represents the *maximum* sieve size.
No. 16	22 - 34	28 – 42	
No. 50	11 - 23	11 – 23	
No.200	3 - 7	3 – 7	

B. Emulsified Asphalt Slurry, Type I: As per Section 320113.16.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Verify that the road base has been properly compacted and is at the correct line, grade, and slope.

C. Verify that the road base thickness is as indicated on the project plans.

D. Verify that sufficient depth at curbs, walks, lips and other vertical edges is available to place the required thickness of compacted asphalt.

E. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons or other vehicle with similar axel weight.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Engineer, and replace with compacted backfill or fill as directed.

F. Install borrow, subbase and untreated base layers, as required by project plans, in accordance with section 312000 Earthmoving.

G. Proceed with asphalt paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

C. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.

D. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

E. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.08 to 0.10 gal./sq. yd.

F. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

G. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

H. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

I. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and,

while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
2. Clean cracks and joints in existing hot-mix asphalt pavement.
3. Fill and Seal Joints and Cracks as per Section 320117.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Not used.

C. Prime Coat: Do not use if paving takes place not more than 48 hours after final compaction and grading of road bases. If paving must be delayed significantly, re-grade and re-compact road base or apply Prime Coat. Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.20 gal./sq. yd. Achieve minimum 98% coverage of surface. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.08 to 0.10 gal./sq. yd.

1. Achieve minimum 98% coverage of surface.
2. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
3. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings.
4. Remove and replace items damaged by overspray or clean affected surfaces as directed by architect at no additional cost to owner.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place 3-inch minimum compacted thickness unless otherwise indicated on the drawings.
2. Place hot-mix asphalt surface course in single lift if design thickness is less than 3-inches. If design thickness is more than 3-inches, place in multiple lifts with a minimum thickness of 1.5-inches and a maximum thickness of 3-inches.
3. Spread mix at minimum temperature of 250 deg F.

4. Place mix in a manner to maintain and/or establish crown as identified in the drawings.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Locate joints a minimum of 18 inches from designed wheelpath.
3. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
4. Offset transverse joints, in successive courses, a minimum of 24 inches.
5. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
6. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
7. Compact asphalt at joints to a density within 2 percent of minimum specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot- mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: Not less than 93 percent of reference laboratory density according to ASTM D 2041 or AASHTO T 209, but not greater than 96 percent, with no individual tests below 90 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Place asphalt so that final compacted asphalt is even with lip of gutter on curbs that drain away from the curb and gutter (open face or depressed curb and gutter). Place asphalt so that final compacted asphalt is 1/4-inch above lip of gutter on curbs that carry water (slope of parking lot is towards the curb). In transition areas, use extra care to make sure that no ponds, bird baths, or depressions are left after paving.

G. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the total design thickness indicated within the following tolerances:

B. Surface Course: Plus 1/4 inch, no minus.

C. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

D. Surface Course: 1/8 inch.

E. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

F. After paving is complete, pour water on paved areas and identify ponds, bird baths, and depressions. Identify the same at open face and transition sections of curb and gutter.

G. Remove and replace asphalt, curb and gutter, road base, and or sub-base as necessary to fix ponds, bird baths, or depressions at no additional cost to owner

3.9 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness according to Section 320113.16 Slurry Type I and allow curing.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect and approved by the local jurisdictional fire marshal.

B. Allow paving to age for 7 days minimum days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

E. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

F. Color

1. Yellow: Parking stalls and pedestrian crossings.
2. Blue: Handicap insignia at appropriate stalls.
3. Red: Fire lanes and no parking areas.
4. White: Directional arrows.

3.11 FIELD QUALITY CONTROL

A. HMA Mixing Plant: Use a UDOT 514 QMP certified Asphalt Mix Plant.

1. Submit plant certification documentation with mix design.
2. Submit daily plant production records within 1 working day after completion of each day of paving and prior to the start of the next paving day.

B. Perform Quality Control efforts sufficient to demonstrate material produced meets requirements of this specification.

1. Submit Quality Control data to the Engineer within 1 working day after completion of each day of paving or prior to the start of the next paving day, whichever is sooner.

C. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.12 FIELD QUALITY ASSURANCE

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

E. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

F. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726. Cores will also be measured for compacted thickness. The owner and architect may also direct additional cores to be taken at locations of their choosing to verify final pavement thickness.

1. One core sample will be taken for every 1000 sq. yd. or less of installed

pavement, with no fewer than 3 cores taken.

2. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
3. Coordinate the time and locations of all holes so that cores may be filled.

G. The contractor will replace and compact hot-mix asphalt where core tests were taken.

H. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

END OF SECTION

PAGE INTENTIONALLY LEFT BLANK

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 321313

CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Driveways and roadways.
2. Parking lots.
3. Curbs and gutters.
4. Walkways.
5. Unit paver base.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
3. Division 32 Section "Decorative Concrete Paving" for surface-imprinted, stamped finished concrete pavement.
4. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Qualification Data: For manufacturer and testing agency.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

F. Field quality-control test reports.

G. Minutes of pre-installation conference.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Architect.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete producer.
d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following Cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement and as specified in Division 3 except that for exterior concrete, the minimum compressive strength is 4500 psi at 28 days.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and Cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of Cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

1. Products:

a. Monofilament Fibers:

1) Axim Concrete Technologies; Fibrasol IIP.
2) Euclid Chemical Company (The); Fiberstrand 100.
3) FORTA Corporation; Forta Mono.
4) Grace, W. R. & Co.--Conn.; Grace MicroFiber.
5) Metalcrete Industries; Polystrand 1000.
6) SI Concrete Systems; Fibermix Stealth.
7) Or engineer approved equal.

b. Fibrillated Fibers:

1) Axim Concrete Technologies; Fibrasol F.
2) FORTA Corporation; Forta.
3) Euclid Chemical Company (The); Fiberstrand F.
4) Grace, W. R. & Co.--Conn.; Grace Fibers.
5) SI Concrete Systems; Fibermesh.
6) Or engineer approved equal.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

1. Products:

a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edeco; BurkeFilm.
c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.

g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, ChemRex Inc.; Confilm.
k. Meadows, W. R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation; Finishing Aid.
p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
q. Or engineer approved equal.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. Products:

a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. Burke by Edoko; Aqua Resin Cure.
c. ChemMasters; Safe-Cure Clear.
d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
f. Euclid Chemical Company (The); Kurez DR VOX.
g. Kaufman Products, Inc.; Thinfilm 420.
h. Lambert Corporation; Aqua Kure-Clear.
i. L&M Construction Chemicals, Inc.; L&M Cure R.
j. Meadows, W. R., Inc.; 1100 Clear.
k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
l. Symons Corporation; Resi-Chem Clear.
m. Tamms Industries Inc.; Horncure WB 30.
n. Unitex; Hydro Cure 309.
o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
p. Or engineer approved equal.

F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

1. Products:

a. Anti-Hydro International, Inc.; AH Curing Compound #2 WP WB.
b. Burke by Edoco; Resin Emulsion White.
c. ChemMasters; Safe-Cure 2000.
d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
e. Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).
f. Euclid Chemical Company (The); Kurez VOX White Pigmented.
g. Kaufman Products, Inc.; Thinfilm 450.
h. Lambert Corporation; Aqua Kure-White.
i. L&M Construction Chemicals, Inc.; L&M Cure R-2.
j. Meadows, W. R., Inc.; 1200-White.
k. Symons Corporation; Resi-Chem White.
l. Tamms Industries, Inc.; Horncure 200-W.
m. Unitex; Hydro White.
n. Vexcon Chemicals, Inc.; Certi-Vex Enviocure White 100.
o. Or engineer approved equal.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Color stain: Match Architect's sample or as selected by Architect from manufacturer's full range of stains.

C. Bonding Agent: ASTM C 1059, Type II, non-re-dispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:

1. Types types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Products:

a. Burke by Edeco; True Etch Surface Retarder.
b. ChemMasters; Exposee.
c. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
d. Euclid Chemical Company (The); Surface Retarder S.
e. Kaufman Products, Inc.; Expose.
f. Metalcrete Industries; Surftard.
g. Nox-Crete Products Group, Kinsman Corporation; Crete-Nox TA.
h. Scofield, L. M. Company; Lithotex.
i. Sika Corporation, Inc.; Rugasol-S.
j. Vexcon Chemicals, Inc.; Certi-Vex Envioset.
k. Or engineer approved equal.

F. Pigmented Mineral Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

1. Products:

a. Conspec Marketing & Manufacturing Co., Inc.; Conshake 600 Colortone.
b. Dayton Superior Corporation; Quartz Tuff.
c. Euclid Chemical Company (The); Surflex.
d. Lambert Corporation; Colorhard.
e. L&M Construction Chemicals, Inc.; Quartz Plate FF.
f. MBT Protection and Repair, ChemRex Inc.; Mastercron.
g. Metalcrete Industries; Floor Quartz.
h. Scofield, L. M. Company; Lithochrome Color Hardener.
i. Symons Corporation; Hard Top.
j. Or engineer approved equal.

2. Color: Match Architect's sample or as selected by Architect from manufacturer's full range.

2.7 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type I or II or AASHTO M 248, Type N or F.

1. Color: White, Yellow, Blue. See Section 321216 for color locations.

B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.

1. Color: White, Yellow, Blue. See Section 321216 for color locations.

C. Glass Beads: AASHTO M 247, Type 1.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4500 psi
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45
3. Select slump limit from options in subparagraph below or revise to suit Project.
4. Slump Limit: 4 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 5-8 percent nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture, high-range, water-reducing admixture, high-range, water-reducing and retarding admixture, plasticizing, and retarding admixture in concrete, as required, for placement and workability.
2. Specify admixtures as part of submittal. Verify that admixtures proposed do not adversely affect stained concrete and will not modify colors of stain.
3. Coordinate acceptability of admixtures with architect.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows**:**

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

G. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. where specified and approved in mix submittal.

H. Color Stain: Add stain to concrete per manufacturers recommendations and to meet color required by architect and owner on areas of stained concrete.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons or similar axel weight vehicle.
3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
2. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site.

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Screed pavement surfaces with a straightedge and strike off.

J. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

K. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

L. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

M. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

N. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

O. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared, and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8-inch-deep with a stiff-bristled broom, perpendicular to line of traffic.
4. Coordinate with architect the locations of each type of finish.

3.7 SPECIAL FINISHES

A. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to pavement surface according to manufacturer's written instructions and as follows:

1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match pavement color required.
2. Uniformly distribute approximately two-thirds of dry-shake hardener over pavement surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second dry-shake hardener application, uniformly distributing remainder of material at right angles to first application to ensure uniform color and embed by power floating.
3. After final floating, apply a hand-trowel finish followed by a broom finish to concrete.
4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

B. Coordinate the locations of finishes with the architect and owner prior to placing concrete.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screening, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8-inch, minus 1/4 inch.
3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete pavement to cure for 14 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 100-cu. yd. or 5000 sq. ft. or fraction thereof of each concrete mix placed each day.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 321373

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 07 Section "Joint Sealants" for sealing non-traffic and traffic joints in locations not specified in this Section.
2. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
3. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For installer and testing agency.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than six (6) pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
3. When joint substrates are wet or covered with frost.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

A. Multi component Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:

1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.

a. Available Products:

1) Pecora Corporation; Urexpan NR-300.
2) Engineer approved equal.

2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.

a. Available Products:

1) Meadows, W. R., Inc.; Sealtight Gardox.
2) Engineer Approved Equal.

3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

a. Available Products:

1) Tremco Sealant/Waterproofing Division; Vulkem 202.
2) Engineer approved Equal.

B. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

1. Available Products:

a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1.
b. Engineer Approved Equal.

C. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Available Products:

a. Crafco Inc.; RoadSaver Silicone.
b. Dow Corning Corporation; 888.
c. Engineer Approved Equal.

D. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Available Products:

a. Crafco Inc.; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.
c. Engineer Approved Equal.

E. Multicomponent Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

1. Available Products:

a. Meadows, W. R., Inc.; Sof-Seal.
b. Engineer Approved Equal.

2.4 HOT-APPLIED JOINT SEALANTS

A. Jet-Fuel-Resistant Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3569.

1. Available Products:

a. Crafco Inc.; Superseal 444/777.
b. Meadows, W. R., Inc.; Poly-Jet 3569.
c. Engineer Approved Equal.

B. Jet-Fuel-Resistant Sealant for Concrete and Tar Concrete: Single-component formulation complying with ASTM D 3581.

1. Available Products:

a. Crafco Inc.; Superseal 1614A.
b. Meadows, W. R., Inc.; Poly-Jet 1614.
c. Meadows, W. R., Inc.; Poly-Jet 3406.
d. Meadows, W. R., Inc.; Poly-Jet 3569.
e. Engineer Approved Equal.

C. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Available Products:

a. Crafco Inc.; Superseal 444/777.
b. Meadows, W. R., Inc.; Poly-Jet 3406.
c. Engineer Approved Equal.

D. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

1. Available Products:

a. Koch Materials Company; Product No. 9005.
b. Koch Materials Company; Product No. 9030.
c. Meadows, W. R., Inc.; Sealtight Hi-Spec.
d. Engineer Approved Equal.

2.5 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.6 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 321715
PARKING ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes parking accessories and supplementary items necessary to complete their installation for the following:

1. Pavement markings.
2. Concrete wheel stops
3. Speed bumps.
4. Overhead clearance bars.
5. Traffic control and safety signs.
6. Convex surveillance mirrors.

B. Related Section: Division 11 Section "Parking Control Equipment" for parking gates and control equipment.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Pavement Markings: Include technical data and tested physical and performance properties.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Pavement Markings:

a. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
b. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples for Pavement Markings: For each exposed product and for each color and texture specified; on rigid backing, 8 inches (200 mm) square.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and with sufficient production capability, facilities, and personnel to produce required Work.

B. MPI Standards for Pavement Markings:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" and "MPI Maintenance Repainting Manual" for products and paint systems indicated.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Pavement Markings: Review methods and procedures related to marking pavement including, but not limited to, the following:

a. Pavement aging period before application of pavement markings.
b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.5 FIELD CONDITIONS

A. Environmental Limitations for Waterborne Pavement Markings: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

B. Environmental Limitations for Alkyd Pavement Markings: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4.4 deg C) for alkyd materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

2.2 PAVEMENT MARKINGS

A. Waterborne Pavement Marking Paint:

1. Asphalt Substrates: Comply with MPI System EXT 2.1A, MPI #97, latex traffic-marking paint.
2. Concrete Substrates: Comply with MPI System EXT 3.2E, MPI #97, latex traffic-marking paint.
3. Colors:

a. White: Parking stalls and direction markings.
b. Yellow: Pedestrian cross walks.
c. Red: Fire lanes.
d. Blue and White: Handicapped parking symbols.
e. Locations: As indicated on drawings.

B. Alkyd Pavement Marking Paint:

1. Asphalt Substrates: Comply with MPI System EXT 2.1B, MPI #32, alkyd traffic-marking paint.
2. Concrete Substrates: Comply with MPI System EXT 3.2F, MPI #32, alkyd traffic-marking paint.
3. Colors:

a. White: Parking stalls and direction markings.
b. Yellow: Pedestrian cross walks.
c. Red: Fire lanes.
d. Blue and White: Handicapped parking symbols.
e. Locations: As indicated on drawings.

2.3 CONCRETE WHEEL STOPS

A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 4000 psi (27.6 MPa) minimum compressive strength, 4-1/2 inches (112 mm) high by 9 inches (225 mm) wide by 72 inches (1800 mm) long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of three factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.

1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.

B. Mounting Hardware:

1. Asphalt Substrates: Galvanized-steel spike or dowel, 1/2 inch (12 mm) diameter, 10 inch (250 mm) minimum length.
2. Concrete Substrates: Galvanized-steel lag screw, shield, and washers; 1/2 inch (12 mm) diameter, 8 inch (200 mm) minimum length.

C. Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

2.4 SPEED BUMPS

A. Speed Bumps: Solid, integrally colored, 96 percent postconsumer or commingled postconsumer and preconsumer recycled rubber or plastic; UV stabilized. Provide factory-formed or -drilled vertical holes for anchoring to substrate.

1. Size: 2 inches (50 mm) high by 10 inches (250 mm) wide by 72 inches (1800 mm) long; with tapered, square, or rounded ends.
2. Color: Black.
3. Embedded Markings: Molded-in, yellow reflective markings, permanently inset in exposed surface.

B. Mounting Hardware:

1. Asphalt Substrates: Galvanized-steel spike or dowel, 1/2 inch (12 mm) diameter, 10 inch (250 mm) minimum length.
2. Concrete Substrates: Galvanized-steel lag screw, shield, and washers; 1/2 inch (12 mm) diameter, 8 inch (200 mm) minimum length.

C. Adhesive: As recommended by device manufacturer for adhesion to pavement.

2.5 OVERHEAD CLEARANCE BARS

A. Refer to Sign Graphic Consultant Documents.

B. Pipe: Provide 4 inch (100 mm) diameter piping of one the following materials:

1. PVC: ASTM D 3034, PVC sewer pipe, painted.
2. Aluminum: ASTM B 429 (ASTM B 429M), Alloy 6063-T6; mill finish.

C. Chain: ASTM A 413, Grade 30 Carbon steel chain, 1/4 inch (6 mm) nominal size.

D. Supports: 1/4 inch (6 mm) galvanized steel eye bolt and expansion anchors for concrete.

2.6 TRAFFIC CONTROL AND SAFETY SIGNS

A. Compliance Standard: Provide traffic control and safety signage compliant with Manual on Uniform Control Devices (MUTCD) and with state highway standards of Project location where applicable.

B. Traffic Control and Safety Signage: Provide message signs (STOP, YIELD, DO NOT ENTER, SPEED LIMIT, ETC) as indicated on drawings.

C. Parking for the Disabled Signage: Provide signage design as indicated on the drawings.

2.7 CONVEX SURVEILLANCE MIRRORS

A. Convex Surveillance Mirrors: Plexiglas, 26 inch (650 mm) diameter, outdoor round convex mirror, ABS backing.

B. Manufacturer and Product: Meek Mirrors LLC; Model M1924.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator’s written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF PAVEMENT MARKINGS

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

3.5 INSTALLATION OF CONCRETE WHEEL STOPS

A. Install devices in bed of adhesive before anchoring.

B. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

3.6 INSTALLATION OF SPEED BUMPS

A. Install devices in bed of adhesive before anchoring.

B. Securely anchor devices to pavement with hardware spaced as recommended in writing by manufacturer for heavy traffic. Recess head of hardware beneath top surface of device.

3.7 INSTALLATION OF OVERHEAD CLEARANCE BAR

A. Mounting Height: Set horizontal pipe at maximum clearance as indicated on drawings.

B. Support Mechanism: Support with steel chain of length required for clearance.

C. Lettering: Paint with stencil, 2 inch (50 mm) high lettering indicating maximum clearance as follows:

1. Imperial Units: CLEARANCE X-FT X-IN
2. Metric Units: CLEARANCE X-M

D. Lettering: Stenciled; 2 inch (50 mm) high; limiting height as indicated on drawings.

3.8 INSTALLATION OF TRAFFIC CONTROL AND SAFETY SIGNS

A. Mounting Method: Set steel posts in 8 inch (200 mm) diameter concrete footing 12 inches (300 mm) deep unless indicated to be surface mounted.

B. Mounting Height of Signage: As indicated on drawings.

3.9 INSTALLATION OF CONVEX SURVEILLANCE MIRRORS

A. Mounting: Installation shall be fully adjustable for proper observation.

3.10 PROTECTING AND CLEANING FOR PAVEMENT MARKINGS

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 321813
SYNTHETIC GRASS PLAYING FIELD TURF

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Synthetic grass field turf system, transition strips and supplementary items necessary to complete their installation in accordance with the Manufacturer's instructions and approved shop drawings.

1. Permanently fixed synthetic grass field turf.
2. Removable synthetic grass field turf.
3. Field markings for football, soccer, baseball and other events.
4. Transitions and perimeter edge details required for the system in accordance with the Manufacturer's recommendations and approved by the Owner.

B. Proposal Drawings: Submit with bid or proposal, preliminary product data and shop drawings for products and systems including the interface with adjacent construction, including transition strips, and Work to be performed by other contractors. Proposal drawings shall clearly indicate quality and scope of proposed systems.

1. Bidding Responsibility: Bidder shall advise the Architect in writing, prior to receipt of bids, of any modification required in the work specified by this Section to accommodate the proposed turf systems. Modifications requested during construction are the responsibility of the Contractor.

C. Sample Warranty: Submit with bid or proposal, Manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions.

1. Submit a sample of separate Warranty Insurance Policy.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each artificial grass field turf product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

a. Include manufacturer's instructions for maintenance for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.

2. Include data substantiating the turf systems comply with requirements.

a. Include fiber manufacturer's name, type of fiber and composition of fiber.
b. Include test data indicating completed field turf installation meets shock attenuation requirements per ASTM F1936.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Indicate adaptation of manufacturer's standard turf systems to the project, including but not limited to the following:

a. Include sections and details.

1) Show methods of attachment, field openings and perimeter conditions.

b. Show locations of seams and method of seaming.
c. Show layout of game lines, numbers, and letters. Indicate application method of each line and marking.
d. Show location and layout of team logo/graphics as determined by the Owner.

C. Samples: For each type of turf system indicated. Label each sample with manufacturer's name, material description, and designation indicated on Drawings.

1. Turf Fabric: 36 inches (900 mm) square.
2. Game Line Turf Fabric: 36 inches (900 mm) long by actual width.
3. Infill Material: 4 oz. (100 g) of each type.
4. Turf Seam: 36 inches (900 mm) long by actual width.
5. Edge and Accessories: 36 inches (900 mm) long by actual width.
6. Shock-Attenuation Pad: 12 inches (300 mm) square.

1.3 INFORMATIONAL SUBMITTALS

A. Field Quality Control Reports: Written report of testing and inspection required by “Field Quality Control”.

B. Warranty: Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1. Forms shall be completed in Owner's name and registered with Manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Furnish for inclusion in operation and maintenance manual, submit manufacturer's instructions for operation and maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1. Maintenance Manuals: Three copies of manuals, including instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and permanent markings.
2. Project Record Documents: Record locations of seams, drains or other pertinent information.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Materials: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Turf Fabric: Each type of turf indicated; quantity as determined by Owner.
2. Infill: Each type of infill indicated, quantity as determined by Owner.
3. Seaming Tape and Adhesive: If applicable, one roll of seaming tape and one gallon of adhesive.
4. Maintenance Tools: Each type recommended by synthetic grass surfacing manufacturer for installation; quantity as determined by Owner.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

1. Materials, including infill material and fiber proposed for this field, shall have an “In Play” record of at least five years for successful in-service performance.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 10 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 10 years of experience installing products and systems similar to scope of this Project.

   a. Supervisory personnel on the project shall be certified by the Manufacturer in the installation of the artificial grass field turf system, including sewing seams and proper installation of infill mixture.

3. Manufacturer Acceptance: Manufacturer and Installer shall be the same company.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Owner and Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

   a. Architect.
   b. Contractor, including superintendent.
   c. Installer, including project manager and supervisor.
   d. If requested, Manufacturer's qualified technical representative.
   e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

   a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review inspection and testing requirements.
   e. Review environmental conditions and procedures for coping with unfavorable conditions.

f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1. Installer shall obtain approved submittals of related adjacent products, materials and construction, including substrates, for purposes of coordinating the work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store materials in location and manner to allow installation as recommended by manufacturer.

1.11 WARRANTY

A. Manufacturer/Installer Warranty: Furnish written material and labor warranty signed by an authorized representative using manufacturer/installer standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture/design of product or workmanship defects. “Defects” are defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Deterioration and excessive wear.
b. Deterioration from UV light.
c. Excessive loss of shock attenuation.
d. Seam separation, including game lines and markings.

2. Manufacturer/Installer Warranty shall be full, non-prorated, including all costs to complete repairs or replacement insured by a separate Warranty Insurance Policy issued by a Best “A” Rated Insurance Carrier or better. Submit a certified letter directly from the Insurance Carrier stating the coverage is in effect including the following terms and conditions:

a. Pre-Paid 8-Year Insured Warranty provided in the form of one single policy.
b. Per Claim Limit: Not less than $32,000,000.
c. Must cover 100% Full Replacement Value of total square footage installed, including removal and disposal of the existing surface. Policy cannot include any form of deductible amount.
d. No retentions or self-insured provisions.
e. Warranty must be transferable and/or assignable for duration of warranty period.
f. Terms, conditions, inclusions, exclusions, limitations, and obligations shall be clearly listed and defined in common language.
g. Signature by Owner shall not be required.
h. Provisions for resolution of disagreements.
i. Warranty obligation shall begin at date of substantial completion, regardless of status of payment for work by Owner.
j. Warranty shall be governed by laws of location of project.

3. Artificial grass field turf must maintain an ASTM F 355 G-max of <100 at installation and <130 during the warranty period.

B. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 8 years from date of Substantial Completion. Warranty shall be insured by a policy for the full warranty period.

1.12 FIELD TURF MAINTENANCE SERVICE

A. Periodic Maintenance: Inspection and maintenance shall be performed by Manufacturers Authorized Maintenance Personnel.

1. Maintenance Period: Twice per year for each year during the warranty period unless determined otherwise by manufacturer.

a. The maintenance activities include but are not limited to the most current Manufacturers Maintenance Guidelines at the time the maintenance is being undertaken.

1) Fiber fibrillation analysis, Seam analysis, Perimeter anchoring, Excessive wear analysis, UV fade inspection, Infill - consistency in depth, Infill - migration analysis, Glued inlay analysis, Base stability analysis, Painted marking inspection, Debris removal, Brushing, Aerating, Grooming, Removal of weeds and moss, Removal of stains, Keeping the infill level.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers and Products: Subject to compliance with intended aesthetic, functional and performance requirements as judged by the Architect, manufacturers include but are not limited to those listed.

1. AstroTurf USA
2. FieldTurf International Inc.
3. Hellas Construction.
4. Sportexe
5. UBU Sports Inc.

B. Product Standards (Basis of Design): Contract Documents are based on products specified to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and do not change intended aesthetic, functional and performance requirements as judged by Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 SYNTHETIC GRASS FIELD TURF

A. Synthetic Grass Surfacing: Complete surfacing system, consisting of synthetic yarns bound to water-permeable backing and infill indicated, suitable for sports playing fields indicated.

1. Basis of Design - Artificial Grass Field Turf System:

a. Manufacturer and Product: Hellas Construction; matrixTURF Softtop Convertible Turf System.
b. Color: Field Green, unless indicated otherwise.

B. Turf Fabric: Woven turf fabric with multicolored fiber and UV resistance, complying with the following:

1. Carpet shall be furnished in 15' wide rolls. Rolls length shall span from sideline to sideline without splicing.

a. Head seams, other than at sidelines, are not acceptable.

2. Yarn Fiber: Monofilament polyethylene.
3. Pile Weight: 42-46 oz./sq. yd. according to ASTM D 5848.
4. Pile Height: 2.0 - 2.5 inches according to ASTM D 5823.

C. Backing: Manufacturer's standard woven or nonwoven polypropylene primary backing with urethane-coated secondary backing; provide perforations or drainage channels sufficient to meet permeability indicated.

D. Infill: Manufacturer's standard engineered and layered sand and rubber infill.

1. Infill Proportions: Manufacturer's standard proportions recommended for this installation.

a. Basis of Design - Infill: Hellas; Realfill Infill.

E. Game Lines and Markings: Provide game lines and markers in widths and colors according to requirements indicated on Drawings.

1. Application Method: Tufted in to the maximum extent practicable, with remaining lines inlaid.

a. Non-tufted or inlaid lines and markings shall be painted with paint approved by the synthetic turf Manufacturer.
b. Inlays may be sheared in place and adhered with hot melt adhesive as recommended by the turf Manufacturer.

2. Team Logo/Graphic: Provide inlaid team logo/graphic in colors and design indicated.

F. Seaming Method: Manufacturers standard adhesive and/or sewn seams.

2.4 INDOOR TURF COVER SYSTEM

A. General: Dual faced thermoformed high-density polyethylene interlocking panel system with integral non-slip surface pattern, foam filled cavity, 1 ¼” nominal thickness.

1. Basis of Design - Turf Cover: Terraplas North America - Terracover Artificial Turf Cover.
2. Compressive Strength: Not less than 290 lbs/sq in concentrated load and 10,000 lbs/6 sq in.
3. Color: As selected by Owner from full range of manufacturer's standard master colors.
4. Storage System: System shall include manufacturer's standard pallets design specifically for loading and storing panels.

2.5 FIELD TURF AND TURF COVER PERIMETER TRANSITION STRIPS

A. Type: As recommended by Manufacturer and approved by Owner, height and profile as required to safely transition to field turf surface.

2.6 FIELD GROOMER AND SWEEPER

A. Provide field groomer and sweeper.

1. Field Groomer shall include a towing attachment compatible with a field utility vehicle.
2. Field Sweeper shall include a towing attachment compatible with a field utility vehicle.

B. Turf removal.

1. Provide two fork lift hopper attachments as recommended by turf manufacturer for synthetic turf roll removal.

2.7 MATERIALS

A. Rubber Infill: Ground latex-coated SBR crumb rubber mesh free of metal, nonmetal fibers, and contaminants; mesh size as recommended by synthetic grass surfacing manufacturer.

B. Sand Infill: Uniformly sized latex-coated silica sand free of silts, clays, and contaminants, and of subangular or rounder shape according to ASTM F 1632; mesh size as recommended by synthetic grass surfacing manufacturer.

C. Seam Adhesive: One or two-part urethane, recommended or approved by synthetic grass surfacing manufacturer, and suitable for ambient conditions at time of installation.

D. Seam Tape: Synthetic grass manufacturer's recommended seam tape, minimum 12 inches (305 mm) wide, 18 inches (457 mm) wide for inlaid game lines.

E. Seaming Cord: Seaming cord or thread, recommended by the synthetic grass surfacing manufacturer.

F. Shock-Attenuation Pad: Porous composite consisting of rubber granules bound with urethane adhesive, thickness as determined by manufacturer for this installation. Provide shock-attenuation pad with permeability sufficient to meet synthetic grass surfacing assembly permeability requirements.

G. Game Line Paint: Permanent paint as recommended or approved by synthetic grass surfacing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Prior to the beginning of installation, Manufacturer/Installer shall submit written acceptance of the sub-base surface planarity (tolerance-to-grade).
2. The base work shall be performed to the satisfaction of the turf manufacturer/installer.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer, shall undertake any cutting, sewing, gluing, shearing, top-dressing or brushing operations.

C. Designs, markings, layouts and materials shall conform to current rules and standards applicable to this type of synthetic grass installation.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

1. Variances from these requirements must be accepted in writing, by the Manufacturer's on-site representative, and submitted to the Architect/Owner, verifying that the changes do not in any way affect the warranty. Infill materials shall be installed in accordance with the Manufacturer's standard procedures.

3.4 INSTALLATION

A. Shock-Attenuation Pad Installation: Roll out pad and allow to relax a minimum of six hours prior to final fit and trim. Stagger head seams between adjacent rows. Fit seams snugly without stretching or forcing.

B. Roll out turf fabric and allow to relax at least four hours prior to seaming.

C. Provide seams flat and snug, with no gaps or fraying. Remove yarns that are trapped within seams. Attach turf fabric to perimeter restraint system as recommended by the manufacturer.

1. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline. No head or cross seams will be allowed in the main playing area between the sidelines.
2. Use standard state of the art adhesive, sewing and joining procedures to attach each roll.
3. After installing playing surface rolls, install sideline areas at right angles to the playing field turf.

D. Install inlaid game lines and markings by cutting through turf fabric and installing snugly fitting game line turf fabric. Provide seaming tape that extends minimum 6 inches (152 mm) beyond seam.

E. Repair loose seams and bubbles formed due to expansion of turf fabric prior to installation of infill.

F. Evenly broadcast and groom infill by machine in proportions and depth after settling as recommended by the manufacturer, and to meet indicated performance requirements. Rake fibers trapped by infill to surface.

1. Infill materials shall be installed to fill voids between fibers while allowing fibers to remain vertical and non-directional. Install infill to a nominal depth and density recommended by Manufacturer for this installation. Place infill to maintain a void to top of fibers.

G. Painted Game Lines: Apply lines and markings as recommended by the game line paint manufacturer.

1. Prior to application of line painting, turf shall be fibrillated by means of a nylon rotary brush to provide the look, feel, and safety of optimally maintained natural grass, including subtle undulations normally associated with natural grass athletic fields.
2. Non-tufted or inlaid lines and markings shall be painted according to the recommendations of the turf Manufacturer and paint manufacturer. Provide number of applications required appearance and performance.

H. Attach turf to perimeter edge in accordance with the Manufacturer's standard procedures and details approved by Owner. The perimeter edge detail shall be designed to prevent fabric tripping hazard at edge of field.

3.5 FIELD MARKINGS

A. Field markings shall be installed in accordance with approved shop drawings. If football is designated as the primary sport, all five yard lines will be tufted-in.

B. Balance of sports markings will be inlaid or painted in accordance with the Drawings.

C. Center field logo shall be painted or inlaid according to artwork indicated on Drawings in accordance with manufacturer's standard palette of turf colors.

D. End-zone letters and logos shall be painted or inlaid according to artwork and fonts indicated on the Drawings in accordance with manufacturer's standard palette of turf colors.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Owner Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Perform the following tests and inspections:

a. Permeability: Rainfall capacity according to ASTM F 2898 or EN 15330-1.
b. Shock Attenuation: No greater than 100 G(max) at time of installation according to ASTM F 1936.

C. Tests and Inspections, General: Tests and inspections shall take place as installation proceeds to determine compliance with specified performance requirements.

1. Correction of Deficiencies:

a. Materials and installation will be considered defective if they do not meet specified requirements.
b. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
c. Perform additional tests and inspections, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

2. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

A. Protect installed artificial grass field turf from subsequent construction operations. Keep the turf area clean and clear of debris throughout the project. Do not allow traffic over unprotected surfaces

B. Provide labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items. Clean artificial grass filed turf system as necessary to leave the work area in excellent condition and ready for immediate use by the Owner.

C. Usable remnants of new material shall become the property of the Owner.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 321826
SYNTHETIC GRASS TURF

(PENDING AHJ REVIEW)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Permanently fixed synthetic grass turf system, transition strips and supplementary items necessary to complete their installation in accordance with the Manufacturer's instructions and approved shop drawings.

B. Proposal Drawings: Submit with bid or proposal, preliminary product data and shop drawings for products and systems including the interface with adjacent construction, including transition strips, and Work to be performed by other contractors. Proposal drawings shall clearly indicate quality and scope of proposed systems.

1. Bidding Responsibility: Bidder shall advise the Architect in writing, prior to receipt of bids, of any modification required in the work specified by this Section to accommodate the proposed turf systems. Modifications requested during construction are the responsibility of the Contractor.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each artificial grass field turf product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Indicate adaptation of manufacturer's standard turf systems to the project, including but not limited to the following:

a. Include sections and details.

1) Show methods of attachment, field openings and perimeter conditions.

b. Show locations of seams and method of seaming.

C. Samples: For each type of turf system indicated. Label each sample with manufacturer's name, material description, and designation indicated on Drawings.

1. Turf Fabric: 36 inches (900 mm) square.
2. Turf Seam: 36 inches (900 mm) long by actual width.
3. Edge and Accessories: 36 inches (900 mm) long by actual width.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1. Fire Resistance: ASTM E648 Class A Fire Rated.

B. Field Quality Control Reports: Written report of testing and inspection required by “Field Quality Control”.

C. Warranty: Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1. Forms shall be completed in Owner's name and registered with Manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Furnish for inclusion in operation and maintenance manual, submit manufacturer's instructions for operation and maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1. Maintenance Manuals: Three copies of manuals, including instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and permanent markings.
2. Project Record Documents: Record locations of seams, drains or other pertinent information.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Materials: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Turf Fabric: Each type of turf indicated; quantity as determined by Owner.
2. Seaming Tape and Adhesive: If applicable, one roll of seaming tape and one gallon of adhesive.
3. Maintenance Tools: Each type recommended by synthetic grass surfacing manufacturer for installation; quantity as determined by Owner.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 10 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 10 years of experience installing products and systems similar to scope of this Project.

a. Supervisory personnel on the project shall be certified by the Manufacturer in the installation of the artificial grass field turf system, including sewing seams.

3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Owner and Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1. Installer shall obtain approved submittals of related adjacent products, materials and construction, including substrates, for purposes of coordinating the work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store materials in location and manner as recommended by manufacturer.

1.11 WARRANTY

A. Manufacturer/Installer Warranty: Furnish written material and labor warranty signed by an authorized representative using manufacturer/installer standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by

manufacture/design of product or workmanship defects. “Defects” are defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

   a. Deterioration and excessive wear.
   b. Deterioration from UV light.
   c. Seam separation.

B. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Product Standards (Basis of Design): Contract Documents are based on products specified to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and do not change intended aesthetic, functional and performance requirements as judged by Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General: It is the intent of this specification to allow manufacturers to provide a standard system to the extent that such system complies with the design and performance criteria. Provide manufacturers standard system of products, materials, equipment, and components, adapted to the application indicated, that complies with performance requirements indicated.

B. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.

C. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.

   1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.

D. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.

E. Coordination of Work:

   1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

2.4 SYNTHETIC GRASS TURF

A. Synthetic Grass Surfacing: Complete surfacing system, consisting of synthetic yarns bound to water-permeable backing, suitable for activities indicated.

1. Basis of Design - Artificial Synthetic Grass Turf System:

a. Manufacturer and Product: SYNLawn; SYNRye 200.
b. Color: Field Green + Lime / Turf Tan.
c. Test Data: Pass; ASTM E648, ASTM F1292, ASTM F1951, ASTM E108, ASTM E84.

B. Turf Fabric: Woven turf fabric with multicolored fiber and UV resistance.

1. Yarn Type: Manufacturers standard nylon for Grass and Thatch Zones.
2. Face Weight: 56 oz./sq. yd. according to ASTM D 5848.
3. Pile Height: Grass Zone 1.75 inches; Thatch Zone 1.5 inches according to ASTM D 5823.

C. Backing: Manufacturer's standard woven primary backing with 20 oz. secondary backing; provide perforations or drainage channels sufficient to meet permeability indicated.

D. Seaming Method: Manufacturers standard adhesive and/or sewn seams.

2.5 PERIMETER TRANSITION STRIPS

A. Type: As indicated in Drawings and recommended by Manufacturer Owner, height and profile as required to safely transition to field turf surface.

2.6 MATERIALS

A. Seam Adhesive: One or two-part urethane, recommended or approved by synthetic grass surfacing manufacturer, and suitable for ambient conditions at time of installation.

B. Seam Tape: Synthetic grass manufacturer's recommended seam tape, minimum 12 inches (305 mm) wide.

C. Seaming Cord: Seaming cord or thread, recommended by the synthetic grass surfacing manufacturer.

2.7 ACCESSORIES

A. Deck Panels: Pre-engineered sub-base system for rooftop installation.

1. Basis of Design: UltraBase Systems; 1-1/2 Inch Non-Combustible UBS PRO in compliance with ASTM E108.

B. Cable: 1/8 inch stainless steel aircraft cable with loop ties.

C. Anchors: 3/8 inch stainless steel eye bolt screws.

D. Wood Nailers: 2 inch x 4 inch Redwood lumber, anchored to concrete structure with stainless steel anchors at 8 inches on center.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

1. Prior to the beginning of installation, Manufacturer/Installer shall submit written acceptance of the sub-base surface.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer, shall undertake any cutting, sewing, gluing, shearing, top-dressing or brushing operations.

C. Designs, markings, layouts and materials shall conform to current rules and standards applicable to this type of synthetic grass installation.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

1. Variances from these requirements must be accepted in writing, by the Manufacturer's on-site representative, and submitted to the Architect/Owner, verifying that the changes do not in any way affect the warranty.

3.4 INSTALLATION

A. Roll out turf fabric and allow to relax at least four hours prior to seaming.

B. Provide seams flat and snug, with no gaps or fraying. Remove yarns that are trapped within seams. Attach turf fabric to perimeter restraint system as recommended by the manufacturer.

1. Use standard state of the art adhesive, sewing and joining procedures to attach each roll.

C. Repair loose seams and bubbles formed due to expansion of turf fabric.

D. Attach turf to perimeter edge as indicated on Drawings and in accordance with the Manufacturer's standard procedures. The perimeter edge detail shall be designed to prevent fabric tripping hazard at edge of field.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall

submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

3.6 CLEANING AND PROTECTION

A. Protect installed artificial grass field turf from subsequent construction operations. Keep the turf area clean and clear of debris throughout the project. Do not allow traffic over unprotected surfaces

B. Provide labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items. Clean artificial grass filed turf system as necessary to leave the work area in excellent condition and ready for immediate use by the Owner.

C. Usable remnants of new material shall become the property of the Owner.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 323113
CHAIN LINK FENCING

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes chain link fencing and supplementary items necessary to complete their installation for the following:

1. Chain link fences.
2. Gates: Swing.
3. Gates: Horizontal slide.

1.2 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Contractor shall engage a qualified professional engineer to provide engineering for products and systems required to comply with the design intent of Contract Documents.

1. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install Work required for a complete installation.
2. Delegated Engineer Professional Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated with a record of successful in-service performance. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
3. Submittals: Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.
4. Coordination of Work:

a. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
b. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: For the following products, in sizes indicated, showing the full range of color, texture, and pattern variations expected. Prepare Samples from the same material to be used for the Work.

1. Polymer-Coated Steel Wire Fabric: 12 inch by 12 inch (300 mm by 300 mm) square.
2. Polymer-Coated Fencing Components and Accessories: 6 inch (150 mm) lengths for components such as posts, rails, and gate framing (as applicable); full-sized units for accessories.
3. Privacy Slats: 6 inch (150 mm) length.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain link fencing, from manufacturer.

B. Delegated Engineering Submittal: For products and systems indicating compliance with performance requirements. Include structural analysis, calculations and other performance data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

1. Polymer finishes.
2. Gate hardware.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 3 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 3 years of experience installing products and systems similar to scope of this Project.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of products and systems representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance: Chain link fencing framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:

1. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:

a. Wind and other Design Loads: As indicated on Drawings.

2.2 CHAIN LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Mesh Size and Diameter:
   a. Heavy Duty Mesh Size and Wire Diameter: 2 inches (50 mm) mesh, 0.192 inch (4.88 mm) diameter.
   b. Security Mesh and Wire Size: 3/8 inch (9 mm) mesh, 0.120 inch (3 mm) diameter.
3. Zinc-Coated Fabric: ASTM A 392, with zinc coating applied to steel wire before weaving according to ASTM A 817, Type II, zinc coated (galvanized) with Class 2 minimum coating weight of not less than 2.0 oz./sq. ft. (610 g/sq. m) of uncoated wire surface.
4. PVC-Coated Fabric: ASTM F 668, Class 2b over zinc-coated steel wire.
   a. Color: Black, complying with ASTM F 934.
   b. Color: Dark green, complying with ASTM F 934.
   c. Color: As selected by Architect from manufacturer's full range complying with ASTM F 934.
5. Coat selvage ends of fabric that is metallic coated during the weaving process with manufacturer's standard clear protective coating.

B. Selvage:
1. Fabric Height up to 6 feet (1.8 m): Knuckled at both selvages.
2. Fabric Height over 6 feet (1.8 m): Twisted top and knuckled bottom.

2.3 FENCE FRAMING

A. Type I Round Steel Pipe: Standard weight, Schedule 40, galvanized steel pipe complying with ASTM F 1083. Comply with ASTM F 1043, Material Design Group IA, external and internal coating Type A, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) zinc.

B. Type II Round Steel Pipe: Cold-formed, electric-resistance-welded steel pipe. Comply with ASTM F 1043, Material Design Group IC, with minimum yield strength of 50,000-psi (344-MPa); and the following external and internal coatings requirements:
1. Coatings: Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.

C. Roll-Formed C-Section Steel Shapes: C-sections or other shape, produced from structural steel. Comply with ASTM F 1043, Material Design Group II, with minimum yield strength of 45,000 psi (310 MPa); and the following coating requirements:
1. Coating: Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A 123 or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating per ASTM A 653.

D. Roll-Formed H-beam Steel Shapes: Hot-rolled H-beams or other shape, produced from structural steel. Comply with ASTM F 1043, Material Design Group III, with minimum yield strength of 45,000 psi (310 MPa); Coating Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A 123 or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating per ASTM A 653.

E. Square Steel Tubing: Galvanized steel-tubing end, corner, and pull posts and top rail with coating Type A, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) zinc according to ASTM F 1043, and complying with CLFMI's "Product Manual," Type I.

F. End, Corner and Pull Posts: For following fabric heights:

1. Fences up to 6 feet (1.8 m) in Height: 2.375 inches (60 mm) OD Type I or II steel pipe, 2 inches (50 mm) square steel tubing weighing 2.60 lb/ft (3.87 kg/m), or 3.5 by 3.5 inches (87 by 87 mm) roll-formed sections weighing 4.85 lb/ft (7.22 kg/m).
2. Fences over 6 feet (1.8 m) in Height: 2.875 inches (73 mm) OD Type I or II steel pipe, 2.5 inches (62 mm) square steel tubing weighing 5.10 lb/ft (7.59 kg/m), or 3.5 by 3.5 inches (87 by 87 mm) roll-formed sections weighing 4.85 lb/ft (7.22 kg/m).

G. Line or Intermediate Posts: For following fabric heights:

1. Fences up to 6 feet (1.8 m) in Height: 1.9 inches (48 mm) OD Type I or II steel pipe, 1.875 by 1.625 inches (48 by 40 mm) C section weighing 2.28 lb/ft (3.39 kg/m), or 2.25 by 1.7 inches (56 by 43 mm) steel H section weighing 3.26 lb/ft (7.22 kg/m).
2. Fences over 6 feet (1.8 m) in Height: 2.375 inches (60 mm) OD Type I or II steel pipe, 2.25 by 1.7 inches (57 by 42 mm) C section weighing 2.70 lb/ft (4.02 kg/m), or 2.25 by 1.7 inches (56 by 43 mm) steel H section weighing 3.26 lb/ft (7.22 kg/m).

H. Post Brace Rails: Match top rail for coating and strength and stiffness requirements. Provide brace rail with truss rod assembly for each gate (as applicable), end, and pull post. Provide two brace rails extending in opposing directions, each with truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.

I. Top Rails: Fabricate top rail from lengths 21 feet (6.2 m) or longer, with swedged-end or fabricated for expansion-type coupling, forming a continuous rail along top of chain link fabric. 1.66 inches (42 mm) O.D. Type 1 or 2 steel pipe or 1-1/4 by 1-5/8 inch (32 by 40 mm) C-section weighing 1.40 lb/ft (2.08 kg/m).

J. Intermediate Rails: For fences over 6 feet (1.8 m) in height, provide intermediate rail. Match top rail for coating and strength and stiffness requirements.

K. Bottom Rails: Match top rail for coating and strength and stiffness requirements.

L. Polymer Coating: Provide framing components with polymer coating over metallic coating.

1. Color: Match chain link fabric, complying with ASTM F 934.

2.4 SWING GATES

A. General: Comply with ASTM F 900 for swing-gate types indicated.

B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.

C. Frames and Bracing: Fabricate members from round or square galvanized steel tubing with outside dimension and weight according to ASTM F 900 for the following gate fabric height:

1. Gates up to 6 feet (1.8 m) in Height: Fabricate perimeter frames of minimum OD Type I or II steel pipe or 1-1/2 inch (38 mm) square galvanized steel tubing weighing 1.84 lb/ft (2.74 kg/m).
2. Gates over 6 feet (1.8 m) in Height: Fabricate perimeter frames of 1.9 inches (48 mm) minimum OD Type I or II steel pipe or 2 inch (50 mm) square galvanized steel tubing weighing 2.52 lb/ft (3.75 kg/m).

D. Frame Corner Construction: Welded or assembled with corner fittings and 5/16 inch (8 mm) diameter, adjustable truss rods for panels 5 feet (1.5 m) wide or wider.

E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and weight according to ASTM F 900 for the following gate fabric leaf widths:

1. Gate Openings up to 6 feet (1.8 m) in Width: 2.875 inches (73 mm) OD Type I or II steel pipe, 2.5 inches (62 mm) square steel tubing weighing 5.10 lb/ft (7.59 kg/m).

2. Gate Openings over 6 feet (1.8 m) and up to 13 feet (4 m) in width: 4 inch (100 mm) OD Type I or II steel pipe.
3. Gate Openings over 13 feet (4 m) and up to 18 feet (5.5 m) in Width: 6.625 inch (165 mm) OD Type I steel pipe.
4. Gate Openings over 18 feet (5.4 m) in Width: 8.625 inch (215 mm) OD Type I steel pipe.

F. Hardware: Latches permitting operation from both sides of gate, hinges, center gate stops and, for each gate leaf more than 5 feet (1.5 m) wide, keepers. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.5 HORIZONTAL SLIDE GATES

A. General: Comply with ASTM F 1184 for slide-gate types indicated:

1. Gate Openings of up to 30 feet (9 m) in Width: Type II Cantilever Slide, Class 1 with external or internal roller assemblies as needed for efficient and adequate installation.
2. Gate Openings of up to 40 feet (12 m) in Width: Type I Overhead Slide

B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.

C. Frames and Bracing: Fabricate from round or square galvanized steel tubing with outside dimension and weight according to ASTM F 1184 for the following gate fabric height:

1. Fences up to 6 feet (1.8 m) in Height: Fabricate perimeter frames of 1.66 inches (42 mm) minimum OD Type I or II steel pipe or 1-1/2 inch (38 mm) square galvanized steel tubing weighing 1.84 lb/ft (2.74 kg/m).
2. Fences over 6 feet (1.8 m) in Height: Fabricate perimeter frames of 1.9 inches (48 mm) minimum OD Type I or II steel pipe or 2 inch (50 mm) square galvanized steel tubing weighing 2.52 lb/ft (3.75 kg/m).

D. Frame Corner Construction:

1. Type I Overhead Slide Gates: Welded or assembled with corner fittings including 5/16 inches (8 mm) diameter, adjustable truss rods for panels 5 feet (1.5 m) wide or wider.
2. Type II Cantilever Slide Gates: Welded.

E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and minimum weight according to ASTM F 1184 for the following gate characteristics:

1. Overhead Slide Gates:

a. Type I Gate: For overhead clearance up to 14 feet (4.3 m) and as follows:

1) Opening width of not more than 10 Feet (3 m): 2.875 inch (71 mm) OD pipe weighing not less than 4.64 lb/ft (6.91 kg/m).

b. Type I Gate: For overhead clearance up to 22 feet (6.7 m) and as follows:

1) Opening width between 10 and 24 feet (3 and 7.3 m): 4 inch (100 mm) OD pipe weighing not less than 6.56 lb/ft (9.76 kg/m).
2) Opening width between 22 and 40 feet (6.7 and 12 m): Two sets of 4 inch (100 mm) OD pipe weighing not less than 6.56 lb/ft (9.76 kg/m) or 6.625 inch (165 mm) OD pipe weighing not less than 18.97 lb/ft (28.23 kg/m).

2. Cantilever Slide Gates:

a. Type II Gate: For opening width up to and including 12 feet (3.6 m): 2.875 inch (71 mm) OD pipe weighing not less than 4.64 lb/ft (6.91 kg/m).
b. Type II Gate: For opening width over 12 feet (3.6 m): 4 inch (100 mm) OD pipe weighing not less than 6.56 lb/ft (9.76 kg/m).

F. Overhead Track Assembly for Overhead Slide Gates: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.

G. Guide Posts and Roller Guards for Cantilever Slide Gates: As required per ASTM F 1184 for Type II, Class 1 gates.

H. Hardware: Latches permitting operation from both sides of gate, locking devices, hangers, roller assemblies and stops fabricated from galvanized steel. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.6 FITTINGS

A. General: Provide fittings for a complete fence installation, including special fittings for corners. Comply with ASTM F 626.

B. Post and Line Caps: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide weathertight closure cap for each post.

1. Provide line post caps with loop to receive top rail.

C. Rail and Brace Ends: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide rail ends or other means for attaching rails securely to each gate (as applicable), corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Rail Sleeves for Top Rails: Hot-dip galvanized pressed steel or round steel tubing. Not less than 6 inches (150 mm) long.
2. Rail Clamps for Intermediate and/or Bottom Rails: Hot-dip galvanized pressed steel. Provide line and corner boulevard clamps for connecting intermediate or bottom rails in the fence line to line posts.

E. Tension and Brace Bands: Hot-dip galvanized pressed steel.

F. Tension Bars: Hot-dip galvanized steel, length not less than 2 inches (50 mm) shorter than full height of chain link fabric. Provide one bar for each gate (as applicable) and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Hot-dip galvanized steel rod and turnbuckle or other means of adjustment.

H. Barbed Wire Arms: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide Type I, single slanted arm, according to ASTM F 626, with clips, slots, or other means for attaching strands of barbed wire integral with post cap; one for each post, unless otherwise indicated. Provide line posts with arms designed with opening to accommodate top rail or tension wire. Provide corner arms at fence corner posts.

I. Tie Wires, Clips, and Fasteners: Provide the following types according to ASTM F 626:

1. Standard Round Wire Ties: For attaching chain link fabric to posts, rails, and frames 0.106-inch- diameter wire; galvanized coating thickness matching coating thickness of chain link fence fabric.
2. Power-driven fasteners for surface mounted posts on concrete.
3. Round Wire Clips: Hot-dip galvanized steel for attaching chain link fabric to H-beam posts.
4. Round Wire Hog Rings: Hot-dip galvanized steel for attaching chain link fabric to horizontal tension wires.

J. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.

a. Polymer Coating: Provide fittings with polymer coating over metallic coating.

1) Color: Match chain link fabric, complying with ASTM F 6264.

2.7 PRIVACY SLATS

A. Material: Polyethylene tubular slats, not less than 0.023 inch (0.58 mm) thick, manufactured for chain link fences from virgin polyethylene containing UV inhibitor, sized to fit mesh specified for direction indicated; with vandal-resistant fasteners and lock strips.

1. Color: As selected by Architect from manufacturer's full range.

B. Material: Aluminum, not less than 0.01 inch (0.25 mm) thick, sized to fit mesh specified for direction indicated.

1. Color: As selected by Architect from manufacturer's full range.

C. Material: Redwood, 5/16 inch (8 mm) thick, sized to fit mesh specified for direction indicated.

2.8 BARBED WIRE

A. Zinc-Coated Steel Barbed Wire: Comply with ASTM A 121, Chain link Fence grade for the following two-strand barbed wire:

1. Standard Size and Construction: 0.099 inch (2.51 mm) diameter line wire with 0.080 inch (2.03 mm) diameter, 2-point round barbs spaced not more than 5 inches (125 mm) o.c.

2.9 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

C. Pipe Sleeves: For posts set into concrete, provide preset hot-dip galvanized steel pipe sleeves complying with ASTM A 53, not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (12 mm) more than outside dimension of post, and flat steel plate forming bottom closure. Coordinate setting of sleeves with Division 03 Section "Cast-in-Place Concrete".

2.10 CAST-IN-PLACE CONCRETE FOR FENCE POSTS SET IN CONCRETE FOOTINGS

A. General: Comply with ACI 301 for cast-in-place concrete.

B. Materials: Portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94.

1. Concrete Mixes: Normal-weight concrete with not less than 3000 psi (20.7 MPa) compressive strength (28 days), 3 inch (75 mm) slump, and 1 inch (25 mm) maximum size aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.
4. ASTM F 567 and more stringent requirements specified.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 FENCE POSTS SET IN EXISTING CAST CONCRETE

A. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

B. Posts Set into Concrete in Voids: Where sleeves have not been cast into concrete, form or core drill holes not less than 5 inches (125 mm) deep and 3/4 inch (19 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

3.5 FENCE POSTS SET IN NEW CONCRETE FOOTINGS

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed or compacted soil.

B. Post Setting: Hand-excavate holes for post foundations in firm, undisturbed or compacted soil. Set posts in concrete footing. Protect portion of posts aboveground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Using mechanical devices to set line posts per ASTM F 567 is not permitted. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.

C. Exposed Concrete Footings: Extend concrete 2 inches (50 mm) above grade, smooth, and shape to shed water.

D. Concealed Concrete Footings: Stop footings 2 inches (50 mm) below grade to allow covering with surface material.

3.6 CHAIN LINK FENCE INSTALLATION

A. Terminal Posts: Locate terminal end, corner, and gate posts (as applicable) per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

B. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c. maximum unless indicated otherwise on the drawings.

C. Post Bracing Assemblies: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts (as applicable) and at both sides of corner and pull posts. Locate horizontal braces at mid-height of fabric on fences with top rail and at two-thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

D. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by fencing manufacturer.

E. Intermediate Rails: Install intermediate rails for fences over 6 feet (1.8 m) in height. Install in one piece at post-height center span, spanning between posts, using fittings, special offset fittings, and accessories.

F. Bottom Rails: Install, spanning between posts, using fittings and accessories.

G. Chain Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches (50 mm) between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, and rails. Anchor to framework so fabric remains under tension after pulling force is released.

H. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts (as applicable) with tension bands spaced not more than 15 inches (375 mm) o.c.

I. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts 12 inches (300 mm) o.c. and to braces 24 inches (600 mm) o.c.

J. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

K. Privacy Slats: Install slats in direction indicated, securely locked in place. If not indicated, then as directed by Architect.

L. Barbed Wire: Where indicated or where directed by Architect, install barbed wire. Install uniformly spaced and angled toward security side of fence. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

3.7 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using

tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.8 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 323115
TUBULAR STEEL FENCING

PART 1 - GENERAL

1.1 SUMMARY

A. Work of this Section includes tubular steel fencing and supplementary items necessary to complete the work required for their installation.

1.2 SYSTEM DESCRIPTION SUMMARY

A. Fencing shall include necessary posts, fittings, fastenings and gates required for a complete and proper installation.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's specifications to evidence compliance with these specifications.

B. Shop Drawings: Submit fabrication details and erection drawings.

C. Samples:

1. Submit finished 12" long sections of posts, pickets and rails to indicate compliance with these specifications.
2. Submit samples of post caps and other required accessories.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

1. Ameristar
2. Monumental Iron Works

3. Builders Fence Company, Inc.
4. Delgard Aluminum Ornamental Fence
5. Specrail

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Series/Model Name: Monumental Iron Works "Estate" with flat top pickets, stile "L".

2.2 MATERIALS

A. Pickets, Rails and Posts:

1. Not less than 16 gage metal, pregalvanized mild steel, formed into square or rectangular tubing with welded seams.
2. After welding, weld zone shall be zinc metalized.
3. Size(s) of pickets, rails and posts shall be as required for fence height.

B. Gates:

1. Gates shall be pre-assembled.
2. Frame of gate shall be welded construction with neat full weld.
3. Hinges and locking device shall be of substantial and practical construction.

2.3 FABRICATION

A. Pickets shall be fastened to rails with stainless steel rivets.

B. Posts shall pre-drilled to accept rails.

C. Rails shall be connected to posts with flat head aluminum drive rivets.

D. Fence components shall be pre-assembled in standard 6'-0" sections.

E. Finish:

1. The fence and components shall be factory finished with a thermosetting polyester powder applied by electrostatic spray and baked at 450 -500 deg. F.
2. Finish color shall be as selected from manufacturers standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive fencing system and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 PREPARATION

A. Prepare concrete curb to insure proper and adequate structural support for the fencing.

B. Prepare substrate surfaces to insure proper and adequate installation, in accordance with the Contract Documents and approved Shop Drawings, or manufacturer's requirements.

C. Field measure and verify dimensions as required.

D. Protect adjacent areas or surfaces from damage as a result of the Work of this Section.

3.3 INSTALLATION

A. Install in accordance with manufacturer's latest published requirements, specifications, details and approved shop drawings.

B. Posts and pickets shall be installed truly vertical and rails shall be parallel to finished grade.

C. Posts shall be set in footings or sleeves as indicated.

3.4 ADJUSTING

A. Adjust and leave Tubular Steel gate in perfect working order.

3.5 PROTECTION

A. After installation, and until Owner acceptance the complete fence shall be retouched wherever paint has been scratched, abraded or otherwise damaged or removed. Retouching paint shall be polyester paint of the same formulation and color as that used for the original painting of the fence.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 323117
GATE OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes work required to complete, as indicated by the Contract Documents, and furnish supplementary items necessary for the proper installation of Gate Operators.

1.2 ACTION SUBMITTALS

A. Design Data: Submit complete and specific design data for products specified.

B. Product Data: Submit manufacturer's specifications to evidence compliance with these specifications.

C. Shop Drawings:

1. Submit complete fabrication details and erection drawings.
2. Submit drawings showing connections to adjacent construction, range of travel, and electrical and mechanical connections to the operator.
3. Drawings shall also show the size and location of the concrete mounting pad.
4. Underground runs of hose and electrical shall be shown on shop drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports:

1. Submit affidavits from the manufacturer demonstrating that the gate mechanism has been tested to 200,000 cycles without breakdown.
2. Each operator shall bear a label indication that the operator mechanism has been tested for full power and pressure of hydraulics, full stress tests of mechanical components and electrical tests of overload devices.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.5 CODES AND REGULATORY REQUIREMENTS

A. Complete electrical work according to local codes and National Electrical Code.

B. Operators shall be built to standards of the Underwriters Laboratories or bear the U.L. label. Field work shall be done to journeyman electrician standards.

1.6 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Per manufacturer's latest published specifications.

1.7 WARRANTY

A. Refer to and conform to requirements in Section 01740 - Warranties and Bonds.

B. Extended Warranty (Beyond any warranties specified in the Conditions of the Contract):

1. Provide a five year warranty against defects in materials or workmanship.
2. Defective materials shall be replaced with new materials furnished by the manufacturer, at no cost to the owner.
3. Labor and other incidental costs are not covered under the factory warranty.

C. Certificate: Provide Certificates of Warranty to Owner.

1.8 MAINTENANCE

A. Train Owner's personnel in general maintenance of the gate operator and accessories and provide two copies of "Operations and maintenance" manuals for the Owner's use. Manuals will identify parts of the equipment for future procurement.

B. Provide a digital video recording, showing the components of the gate operator. Identify parts and systems and show in detail how parts are installed and how they are serviced in the field. The purpose of this video tape is to train operations and maintenance personnel for their continued contact with this equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.

1. Hy-Security Gate Operators.
2. Customline, Inc.
3. Crusader, McKinney Electronics Division.
4. Division of Overhead Door.
5. Stanley.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer: Hy-Security.
2. Series/Model Number: [#222 SS] [#333 MS] Hydraulic Slide Gate Operator.

2.2 MATERIALS

A. Operator shall be modular in design allowing remote location of the control panel and pump package, away from the gate opening.

B. The drive unit and the power unit are complete in themselves and can be located up to 100 feet from each other.

C. Power unit shall be housed in an NEMA 3R enclosure.

D. Drive unit may be mounted at ground level or at the head of an overhead mounted gate.

E. Hydraulic hoses and electrical wires for limit switches. shall be run from overhead to the ground in a 6" x 6" x 1/8" square steel tube.

F. Connection will be tamper resistant.

2.3 OPERATION

A. Operation shall be by means of a metal rail passing between a pair of solid aluminum wheels with polyurethane treads.

B. Operator motors shall be hydraulic and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel.

C. The grip of the drive wheels on the metal rail shall withstand a minimum horizontal pull of 300 pounds without slipping and without distortion of strut arms.

D. Gate panel velocity shall not be less than one foot per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly.

2.4 STANDARD COMPONENTS SHALL INCLUDE AS A MINIMUM:

A. Strut Arms: 6" x 3/8" steel flat bar.

B. Pivots: 3/4" diameter, grade 5 bolts in hinge configuration with flat bars.

C. Tension Spring: 2-1/2" heavy duty, 800 pound capacity.

D. Tension Adjustment: Finger tightened nut, without the use of tools.

E. Drive Release: Must instantly release both motors from contact with rail, for emergency operation.

F. Pushbutton Operation: 3 button station mounted permanently on exterior of electric panel.

G. Limit Switches: Fully adjustable, toggle type, NEMA 4.

H. Electrical Enclosure: NEMA 12/13, sealed to provide protection from spraying of dust, oil, coolants or water.

I. Chassis: 1/4" steel plate, welded and ground edges, smooth to the touch.

J. Cover: Joints welded, filled and ground smooth. Finished corners square and true with no visible joints.

K. Finish: Powder paint finish coat with high gloss, withstanding 1000 hour salt spray test.

L. Drive Wheels: Aluminum hub with polyurethane tread and a durometer hardness not less than 90.

M. Drive Rail: Shall be extruded 6061-T-6, not less than 1/8" thick. Drive rail shall incorporate alignment pins for ease of replacement, splicing and for break-away design. Pins shall provide a perfect butt splice.

N. Hydraulic Hose: Shall be 1/4" synthetic, rated to 2750 P.S.I.

O. Hose Fittings: At manifold shall be quick disconnect type, other locations shall be swivel type.

P. High performance, multiple viscosity, hydraulic oil.

2.5 MINIMUM STANDARD ELECTRICAL COMPONENTS:

A. Industrial Grade, Meeting U.L. or C.S.A. Requirements

B. Pump Motor: 1 HP minimum

C. Components shall have overload protection.

D. Electrical panel enclosures shall be NEMA 12/13.

E. Controls: Industrial grade relays.

F. Transformer: 100 VA non-jumpered taps, for common voltages.

G. Maximum run timer.

2.6 CONTROL DEVICES:

2.7 SAFETY DEVICES (for stopping or reversing the gate travel):

2.8 SAFETY ALARM DEVICES:

2.9 ACCESSORIES:

A. Special locks for operator cover and gate panel.

B. Special features to withstand physical attack, (add "CF").

C. Master/slave control package.

D. Heater with thermostat for cold or damp climates.

E. Insulated and weatherstripped operator covers.

F. Remote gate release devices.

G. Special controls for extra duty or gates weighing more than 1000 pounds.

H. High speed options for more than one foot per second (speeds up to six feet per second are available).

2.10 SOURCE QUALITY CONTROL (MANUFACTURER/FABRICATOR)

A. Inspections and Testing:

1. Fully assemble and test, at the factory, each gate operator to assure smooth operation, sequencing and electrical connection integrity. Apply physical loads to operator to simulate field conditions. Tests shall simulate physical and electrical loads equal to the full rated capacity of the operator components.
2. Check mechanical connections for tightness and alignment. Check welds for completeness and continuity. Check welded corners and edges for square and straightness.
3. Inspect painted finishes for completeness and gloss. Touch up any imperfections prior to shipment.
4. Check hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operational vibrations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and verify that receiving substrate surfaces of the structure have no defects or errors which would result in poor or potentially defective application or cause latent defects in workmanship.

1. Locate concrete mounting pad in accordance with approved shop drawings.
2. Make sure that gate is operating smoothly under manual conditions before installation of gate operators. Do not proceed if gate is binding or not aligned properly.

B. Report any unsatisfactory conditions to the Architect.

C. Starting installation shall imply acceptance of surfaces.

3.2 PREPARATION

A. Structural Adequacy: Prepare the structure to insure proper and adequate structural support for the materials specified.

B. Substrate Surface: Prepare substrate surfaces to insure proper and adequate installation, in accordance with the Contract Documents and approved Shop Drawings, or manufacturer's requirements.

C. Field Measurements/Verifications: Field measure and verify dimensions as required.

D. Protection of Adjacent Areas or Surfaces: Protect adjacent areas or surfaces from damage as a result of the Work of this Section.

3.3 INSTALLATION

A. Install gate operator in accordance with manufacturer's latest published requirements, instructions, specifications, details and approved shop drawings.

1. Anchor bolts shall be fully concealed in the finished installation.

B. Interface with Other Products: Coordinate and cooperate with supporting, contiguous, adjacent or otherwise related materials trades to ensure a proper, operating installation.

3.4 FIELD QUALITY CONTROL

A. Contractor Testing: Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper gate position.

3.5 DEMONSTRATION AND TRAINING

A. Instructions: Instruct Owner's personnel in proper operation.

B. Demonstrations: Demonstrate operation to Owner's personnel.

3.6 PROTECTION

A. After installation and until Owner acceptance, protect the operators from damage.

B. Remove damaged materials and replace with new, undamaged materials, at no cost to the Owner.

END OF SECTION

SECTION 328400

IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes irrigation system complete as shown and as specified.

B. Any minor items of labor or materials not specifically noted on the drawings or specifications, but obviously necessary for the proper completion of the work, are to be considered as incidental to and included in the contract.

1.2 QUALITY ASSURANCE

A. Permits and Fees: Obtain and pay for all permits required.

B. Manufacturer's Specifications: Follow Manufacturer's current printed specifications and drawings in all cases where such directions cover points not specified or shown in the Drawings.

C. Ordinances and Regulations: All local, municipal and state laws, codes, and regulations governing or relating to all portions of this work are hereby incorporated into and made a part of these Specifications. Anything contained in these Specifications shall not be construed to conflict with any of the above codes, regulations, or requirements of the same. However, when these Specifications and Drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above codes and regulations, the provisions of these Specifications and Drawings shall take precedence.

D. Explanation of Drawings:

1. Due to the scale of the Drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. Carefully investigate the conditions affecting all of the work and plan accordingly, and furnish all required fittings. Install system in such a manner to avoid conflicts with planting, utilities, and architectural features.
2. The irrigation plans are drawn diagrammatically, including piping and equipment locations. Contractor shall make minor adjustments as required to avoid physical elements and conform to the site conditions. Do not install the irrigation system as shown on the Drawings when it is obvious in the field that obstructions, grade differences, utility conflicts, planting conflicts, drainage problems or discrepancies in dimensions exist that might not have been considered in engineering. Bring such obstructions or differences to the attention of the Landscape Architect. In the event this notification is not given, the Contractor shall assume full responsibility for any revision necessary. In all cases, contractor shall insure that there are no conflicts between the irrigation systems, planting (existing and proposed) and existing utilities.

E. Qualifications:

1. Sprinkler Installation Company:

a. Produce certification of the following requirements prior to beginning work of this Section:
b. In irrigation system installation business for five years minimum providing quality of labor and materials described in Contract Documents.
c. Evidence of completing ten projects minimum of scope and quality equal to this project and in timely manner.
d. Certifiable list of suppliers from whom it will be obtaining materials used on this project.
e. Evidence that it utilizes employees with specified experience and in quantity sufficient to perform work of this Section within time limits established by Contract.

2. Workers: Use only trained personnel familiar with required irrigation system installation procedures.

a. Perform installation under direction of foreman or supervisor with five years minimum experience in sprinkling system installations.

F. Regulatory Requirements: Work and materials shall be in accordance with latest rules and regulations, and other applicable state or local laws. Nothing in Contract Documents is to be construed to permit work not conforming to these codes.

G. Pre-Installation Conference: Schedule pre-installation conference after excavation of trenches and installation of sleeves, but before installation of pipe. Notify Owner’s representative, Landscape Architect and General Contractor fourteen minimum of (14) days prior to scheduled start date for such meeting.

1.3 SUBMITTALS

A. Materials List:

1. Within ten (10) days after the award of the Contract, submit six (6) copies of the complete lists of materials proposed for installation, and obtain the Landscape Architect's written approval thereof before proceeding. Use only accepted materials and items of equipment.
2. List all materials by manufacturer's name and model number.

B. Manuals:

1. Prior to the final acceptance of the irrigation system, furnish three (3) individually bound Service Manuals to the Landscape Architect for use by the Owner. The manuals shall contain complete enlarged drawings, diagrams and spare parts lists of all equipment installed showing manufacturer's name and address. In addition, each Service Manual shall contain the following:

a. Index sheet indicating the Contractor's name, address and phone number.
b. Copies of equipment warranties and certificates.
c. List of equipment with names, addresses and telephone numbers of all local manufacturer's representatives.
d. Complete operating and maintenance instructions in sufficient detail to permit operating personnel to understand, operate and maintain all equipment.

C. Record Drawings:

1. Dimension from two (2) permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:

    a. Connection to existing water lines.
    b. Connection to electrical power.
    c. Control wires.
    d. Gate valves.
    e. Routing of sprinkler pressure lines.
    f. Routing of lateral sprinkler non-pressure lines.
    g. Remote control valves.
    h. Routing of control valves.
    i. Quick coupling valves.
    j. All sleeve locations.
    k. Other related equipment as directed by Landscape Architect.

2. Deliver a reproducible Record Drawing to the Landscape Architect within seven (7) working days before the date of Final Inspection. Delivery of the record drawings shall not relieve the Contractor of the responsibility of furnishing required information in the future.

D. Maintenance Material - Supply the following tools to the Owner;

1. Three (3) sets of specialized tools required for removing, disassembling and adjusting each type of sprinkler, valve or other equipment supplied on this project.
2. Two (2) quick-coupler keys and matching hose swivels for each type of quick coupling valve installed.
3. Two (2) five foot valve keys for operation of gate valves.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Furnish and deliver materials in manufacturer's packaging, bearing and original legible labeling.

B. Handle and store all equipment/material in accordance with manufacturer's current printed specifications.

1.5 SEQUENCING AND SCHEDULING

A. Acceptance: Do not install main line trenching prior to acceptance by Landscape Architect of rough grades completed under another Section.

B. Coordination: Coordinate with the work of other sections to insure the following sequence of events.

1. Sleeves and Conduits: Installation of all sleeves and conduits to be located under paving and through walls prior to placement of those materials.
2. Irrigation equipment: All equipment tied to main line, including but not limited to: valves, backflow preventer, quick coupler.
3. Bubbler Heads in Tree Planter Pockets: Install after placement of tree, but prior to backfill with planter soil mix.
4. Drip Line: Install after placement of plants, but prior to backfill with planter soil mix.
5. Irrigation Heads in Pots: Install riser, and seal the penetration of the pot prior to backfill of pot with drainage materials and planter soil mix.

1.6 WARRANTY

A. Contractor to provide a written Warranty on its letterhead for the irrigation system in accordance with the sample warranty form the last page of this specification. File with the Owner or his representative prior to final inspection and acceptance of the irrigation system.

B. Include a copy of the warranty form in the Operations and Maintenance Manual.

C. Filling and repairing depressions and replacing plantings due to settlement of irrigation trenches.

D. Adjusting system to supply proper coverage of areas to receive water.

E. Ensuring system can be adequately drained.

1.7 MAINTENANCE

A. Routine: Inspect and adjust all spray heads/rotors and control valves including raising or lowering to accommodate plant growth, to achieve uniform irrigation at all times. Verify correct operating pressure.

B. Controller: Inspect regularly for power interruption and reset clock as required. Adjust station timing to accommodate changes in plant growth.

C. Drip Irrigation: All of above plus keep strainer clean. Flush lines as required. Inspect emitters for proper flow, and check moisture level at plant rootball weekly for the first month of operation and monthly thereafter.

D. System Failure: Perform all repairs within one (1) operating period. Replacements to match removed products and materials in all respects. Report promptly all damage not resulting from Contractor's operations. Repair all damage caused by Contractor at no expense to Owner.

E. Climate Change: Do not run the irrigation system while raining. Set and program automatic controllers in response to seasonal requirements and requirements of newly-planted materials. Winterize the irrigation system each year to prevent system freezing.

F. Winterizing Procedure: Train Owner's designated personnel by having them assist in winterizing procedure. Drain entire system at end of first watering season following installation.

1. Gate Valves: Valves are to be in open position to allow complete drainage.

PART 2 - PRODUCTS

2.1 GENERAL

A. Use only new materials of brands and types noted on Drawings or substitutes accepted by Landscape Architect.

2.2 PIPE

A. Pressure Main Line Pipe and Fittings: All PVC fittings shall bear the manufacturer's trademark name, material designation, size, applicable I.P.S. schedule and NSF seal of approval.

1. PVC pressure rated pipe: ASTM D2241 NSF approved Type II, Grade I, PVC. All pipe must meet Federal Specifications pS-22-70, with an appropriate standard dimension ratio (S.D.R.)

a. Fittings 2” and 3” on the main pressure line shall be Schedule 80 pressure rated PVC. Pipe fittings 4” and larger on the main pressure line shall be cast iron by Harco.

2. PVC scheduled pipe: ASTM D1785 NSF approved Type II, Grade I, PVC. All pipe must meet Federal Specifications PS-21-70.
3. PVC solvent-weld fittings: ASTM D2466 Schedule 40, 1-2, II-I NSF approved.
4. Solvent cement and primer for PVC solvent-weld pipe and fittings: Type and installation methods prescribed by the manufacturer.
5. Connections between main lines and RCVs: Schedule 80 PVC (threaded both ends) nipples and fittings.
6. Galvanized pipe: ASTM A-53 and A120-84, ANSI B1.20.1 and B36.10 Seamless standard weight steel.
7. Copper pipe: ASTM B 42-84 or as specified by local plumbing code, Type L or K copper water pipe.

B. PVC Non-Pressure Lateral Line Piping and Sleeving:

1. PVC pressure rated pipe: ASTM D2241 NSF approved Type II Grade I, PVC and Federal Specification PS-22-70, with an appropriate standard dimension ratio (S.D.R.).

a. All 2” fittings and smaller shall be Schedule 80 pressure rated PVC.

2. PVC scheduled pipe: ASTM D1785 NSF approved Type II Grade I, PVC and Federal Specification PS-21-70.
3. PVC solvent - weld fittings: ASTM D2466 Schedule 80, 1-2, II-I NSF approved.
4. Flexible PVC: ASTM D-2287 Algae-resistant flexible PVC.
5. Polyethylene: ASTM D2237-83, 80 PSI.
6. Copper: ASTM B-42-84 Type L or K.

2.3 SPRINKLERS

A. Rotor Heads:

1. See Drawings.
2. All stream rotary and impact heads shall be installed on swing joint assemblies with three Schedule 40 1” street ells and one 1x8 Schedule 80 nipple or pre-assembled swing joint by Spears or Lasco.

B. Drip Emitters: See Drawings.

2.4 SURFACE DRIP LINE

1. Type: See Drawings for manufacturer and model number.

2. Install per manufacturers recommendations including air relief valve, manual flush valves, and check valves as necessary for elevation changes are greater than 8'.
3. Install one (min.) or two drip line indicator for each dripline field.

2.5 CONTROL WIRES AND SPLICES

A. Type: Copper with UL approval for direct burial, size 14-1. Common ground wire with white insulating jacket; individual control wires with insulating jacket of color other than white.

B. Splices: DBR/Y by 3M for traditional wire control systems

C. Type: As per manufacturer recommendations for "two-wire" type controller.

D. Splices: DBR/Y by 3M for Two-Wire / decoder based control systems.

2.6 REMOTE CONTROL VALVES

A. Type: See Drawings

2.7 BOXES FOR REMOTE CONTROL VALVES

A. For softscape areas:

1. Type: Rectangular plastic valve box - Ametek, Brooks, Christy, Rain Bird or accepted equal.
2. Lid: T-Type and Bolt down or lockable
3. Color: Green in lawn areas and tan in bark mulch areas.

B. For hardscape areas:

1. Type: Precast concrete box
2. Lid: Concrete w/ "Irrigation" and/or "Water" label permanently marked for identification.

2.8 ISOLATION VALVES

A. Ball valves 2-1/2 inches and smaller: Threaded, 2-piece, full port, brass, Blow-out proof stem, operation handle.

B. Gate valves 3 inches and larger: 125 point WSP, iron body, bronze mounted, non rising stem, solid wedge disc.

C. Box: 10" round plastic, Ametek, Brooks, Christy, Rainbird or accepted equal.

1. Color: Green in lawn areas and tan in bark mulch areas.

2.9 QUICK COUPLER VALVE

A. Install as specified on drawings.

1. Keys: Same manufacturer as Quick-Coupling valve. Quantity: Two (2).

2.10 BACKFILL MATERIAL

A. Backfill soil around lateral and main line pipe shall be of same soil as approved in topsoil specification. In no case shall backfill contain rocks larger than half inch in any direction.

2.11 GRAVEL

A. For use around drains, valves boxes, valves, and quick couplers

1. Quarter inch (min.) and three-quarter inch (max.) size angular, washed stone.

2.12 VALVE TAGS

A. Aluminum or plastic tag w/ embedded or raised numbers:

1. Rainbird, Christy, or as approved by Landscape Architect before use.

2.13 MISCELLANEOUS INSTALLATION MATERIALS

A. Solvent cement and primers for solvent weld joints: Make and type approved by manufacturer(s) of pipe and fittings. Maintain cement proper consistency throughout use.

B. Pipe joint compound: Permatex 51-D. Do not use on sprinkler inlet port.

C. Coatings for below grade steel pipe and fittings: Koppers Bitumastic #300-M coal tar epoxy and wrapped with 50-mil polyethylene tape to 6" above finish grade.

2.14 MISCELLANEOUS EQUIPMENT/ACCESSORIES

A. Sleeves and Conduits: See Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Sleeves and Conduits: Verify that all installed sleeves and conduits are undisturbed and are free of defects or errors introduced by the work of other Sections.

B. Water Pressure: Test and verify that the existing iriinstallation of irrigation water meter by others has generated level of water pressure specified on Drawings. Report any discrepancies in water pressure to Landscape Architect prior to installation of system.

C. Mechanical Room: Inspect and verify acceptability of room in building designated to receive automatic controller(s).

D. Stub-outs: Verify that all stub-outs to be provided under another contract are correctly sized, located and installed as noted on Drawings.

E. Notification: Submit written notification to Landscape Architect within ten (10) working days of above inspections describing all acceptable and non-acceptable site conditions.

3.2 INSTALLATION

A. Examination:

1. Site Verification of Conditions:

a. Prior to starting work contractor shall perform pressure test at stub-out on main water line provided for irrigation system, at or nearby fire hydrant. Notify Landscape Architect if pressures are over 110 psi or under 75 psi, failure to notify Landscape Architect of discrepancy may result in contractor to re-install/modify irrigation at no additional cost to owner.

B. Conduits and Sleeves:

1. Coordination:

a. Sleeves will exist only when installed under another subcontract. Inspect as specified above.
b. For all other installations, provide conduit and sleeve materials and coordinate installation with other trades.

2. Extent: Install conduits and sleeves where control wires and pipes pass under paving or through walls. Extend 12” beyond edges of paving and walls and cap ends until ready for use.
3. Pipe and control wiring and tubing under walks, roads and other hard surfaces shall be installed in Class 200 PVC sleeves of adequate size. Sleeves shall be installed under all streets and pavement wider than the five feet.
4. All mainline sleeve locations are to have a second empty sleeve installed.
5. Sleeves for control wires shall be have minimum conduit size as per chart:

Number of Wires	Minimum Conduit Size
1-7	1"
8-11	1 -1/2”
12-22	2"
23-31	2 1/2”
32-36	3"

6. Install wire pull box with sweep ells as may be required to route wire to the irrigation controller and maintenance access.

C. Excavating and Trenching:

1. Trenches: Dig trenches wide enough to allow a minimum of 6 inches between parallel pipe lines. Provide a minimum cover from finish grade as follows:

a. 12 inches Deep: Control Wire and Flow Sensor Cable not following piping.
b. 18 inches Deep: Over pipe on non-pressure side of irrigation control valve.
c. Direct Burial PVC Piping Under Pavement: Provide a minimum of 4 inches of sand backfill on all sides and 24 inches cover to bottom of paving.
d. 24-36 inches Deep: Over pipe on pressure side of irrigation control valve, control wires and quick-coupling valves.

D. Pipe Line Assembly:

1. General:

   a. Install pipes and fittings in accordance with manufacturer's current printed Specifications.
   b. Clean all pipes and fittings of dirt, scales and moisture before assembly.

2. Solvent-Welded Joints for PVC Pipes:

   a. Solvents: Use solvents and methods specified by pipe manufacturer.
   b. Curing Period: Minimum of 1 hour before applying any external stress on the piping and at least 24 hours before placing the joint under water pressure.

3. Threaded Joints for Plastic Pipes:

   a. Tape: Use Teflon tape on threaded PVC fittings.
   b. Joining: Use strap-type friction wrench only. Do not use metal-jawed wrench.

4. Threaded Joints for Galvanized Steel Pipes:

   a. General: Use only factory-made nipples.
   b. Joining Compound: Use pipe joint compound applied to male threads only.

5. Laying of Pipe:

   a. Bedding On-grade: Remove from trench all rocks or clods over 3/8 inches diameter or less. Bed pipes in at least 2 inches of soil excavated from trench. Where existing material does not meet this requirement, imported material shall be use. Backfill on all sides of piping to provide a uniform bearing.
   b. Hard Edges: Bed pipes a minimum of 12 inches away from curbs or sidewalks to allow for easy access and maintenance.
   c. Snaking: Snake pipe from side to side of trench bottom to allow for expansion and contraction. Minimum allowance for snaking is one (1) additional foot per 100 ft. of pipe.
   d. Moisture Restrictions: Do not lay PVC pipe when there is water in the trench. Do not assemble PVC pipe unless the pipe is perfectly dry.

6. Main Line Assembly:
   a. All pressurized mainlines greater than 2 inches in size shall be installed with thrust blocks wherever a change of direction occurs and as follows:

      1) Bearing area of concrete thrust-block based on 200 PSI pressure and safe soil bearing load of 2,000 pounds per square foot.
      2) Concrete blocking shall be cast in place and have a minimum of 1/4 square foot bearing against the fittings.
      3) Block shall bear against fittings only and shall be clear of joints.

E. Isolation Valve:

1. Locate in line and adjacent to control valves when possible and aligned in a row when grouped, and locate in planted areas. Install box flush with finish grade, not necessarily level.

2. Permanently mark valve box lid with “IV”, indicating isolation valve. Contractor to submit example of branding prior to performing on installed boxes.

F. Quick Coupler Valves:

1. Locate in line and adjacent to control valves when applicable and aligned in row when grouped. Install box flush with finish grade, not necessarily level.
2. Permanently mark valve box lid with “QC”, indicating quick coupler valve. Contractor to submit example of branding prior to performing on installed boxes.

G. Control Valves:

1. Install in valve boxes where shown on Drawings and group together where practical. Install box flush with finish grade, not necessarily level. Avoid locating in high traffic areas.
2. Where two or more valves are installed adjacent to each other, provide at least 6 inches of separation. Align boxes in a row.
3. Permanently mark valve box lid with valve number(s) and controller name as shown on drawings. Contractor to submit example of branding prior to performing on installed boxes for review and approval.
4. Valve boxes shall be at finished grade with valve stems 4 inches below top of box and with 3 inches of pea gravel under the valve. Isolation valves at all valve banks.

H. Sprinkler Heads:

1. Coordination: Coordinate installation with planting contractor to insure timely and proper placement of heads at new planting.
2. Spacing: Do not exceed spacing shown on drawings or manufacturer’s recommendations.
3. Sprinkler heads next to walks or curbs shall be set 2 inches away from and 2 inches below the top of the walk or curb. The contractor shall set heads at finished grade after the lawn has been established.

I. Automatic Controller:

1. General: Install per local code and manufacturer's current printed Specifications.
2. All new valves are to be connected to the sites existing controller. Contractor is responsible for all new wire runs that may be required and new modules that may be required. If controller is full a second server controller is to be installed.
3. If valve numbers are not indicated on the drawings connect remote control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.
4. Labeling: Affix controller name as labeled on the drawings with (i.e., "CONTROLLER A") on inside of controller cabinet door with minimum of 1” high permanent letters.
5. Irrigation Diagram: Affix a non-fading copy of irrigation diagram to cabinet door below controller name. Irrigation diagram to be sealed between two plastic sheets, 20-mil. minimum thickness. Use a reduced copy of the Record Drawing, for the irrigation diagram clearly showing all valves operated by the controller, station number, valve size, and type of planting irrigated.

J. Control Wiring:

1. General: Install control wires in common trenches with sprinkler mains and laterals wherever possible. Lay to the bottom side of pipe line. Provide looped slack at valves. Snake wires in trench to allow for contraction of wires. Tie wires in bundles at 10 ft. intervals.
2. Extra Length: Provide 30” extra control wire at each remote control valve splice to facilitate the removal of the remote control bonnet to finish grade without cutting wires.
3. Spare: Install one spare wire per controller, unless indicated otherwise on drawings. Wire to be unconnected, spare control wire running from the controller through each intermediate control valve box. Label wire at associated valve box and at opposite ends as “spare wire.”
4. Size: Minimum size of wire is to be determined strictly by the manufacturer's current printed specifications for remote control valves, but not smaller than # 14.
5. Detection Wire: Install a bare copper wire #12 or greater on top of the PVC supply line for the purpose of possible future mine detection search as the control wires are being installed on the bottom of the PVC supply line with electrical tape every ten (10) feet.
6. Splicing: Crimp control wire splices at remote control valves. Seal with specified splicing materials. In-line splices will be allowed only on runs exceeding 2500 ft. All splices not at valve shall be made in a rectangular valve box marked “Irrigation wire”
7. All connections to valves and all splices to be water tight.
8. Controller and Conduits: Wiring to be easily identified, clean and organized so that wire may be maintained, trouble shot and freely replaced in conduit from controller to the direct bury condition.

K. Mastic and Tape: Install mastic and tape on all below grade metallic piping. Install per manufacturer's current printed specifications extending mastic and tape to 6 inches above finish grade.

L. Closing of Pipe and Flushing of Lines:

1. Capping: Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
2. Flushing: Thoroughly flush out all water lines to remove debris before installing heads, valves and other hydrants.

3.3 FIELD QUALITY CONTROL

A. Adjustment of the System:

1. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings.
2. Set all sprinkler heads perpendicular to finished grades unless otherwise noted on the Drawings.

B. Testing of Irrigation System:

1. In the presence of the Landscape Architect test all pressure lines under hydrostatic pressure of 125 pounds per square inch, and prove watertight.
2. Sustain pressure in lines for not less than two (2) hours. If leaks develop, repair and repeat test until entire system passes.
3. When the landscape sprinkler system is completed, perform a coverage test in the presence of the Landscape Architect, to determine if the water coverage for planting areas is adequate.

4. Test controllers individually in the presence of the Owner's Representative and the Landscape Architect. Demonstrate that all control valves operate electrically. Provide vehicles and radio equipment as necessary to expedite this process.
5. Demonstrate to Landscape Architect that irrigation scheduling programmed into controller is adequate for plant requirements without causing runoff, and that scheduling capacities of controller are utilized.
6. Test Master Valve and Flow Sensor or Hydrometer for proper function when installed as a part of contract.

C. Backflow Preventer: Have backflow preventer tested by third party and provide certification that it meets local codes and standards.

3.4 BACKFILL AND COMPACTING

A. General: After system is operating and required tests and reviews have been made, backfill excavations and trenches with clean soil, free of debris. For rooftop planters, structural foam may be used.

B. Backfill for All Soil Trenches: Regardless of the type of pipe covered, compact to minimum 95 percent density under pavements, and 85 percent under planted areas.

C. Backfill at Existing Underground Pipes: Use only backfill material which has been screened to eliminate all materials larger than 3/8 inch when backfilling adjacent to existing underground pipe lines.

D. Compacting: Compact soil trenches in areas to be planted to 85% compaction. Jetting process may be used in those areas.

E. Finishing: Dress off all areas to finish grades.

3.5 RESTORE TO EXISTING CONDITIONS

A. Where trenching is required across existing lawns, uniformly cut strips of sod 6 inches wider than trench. Remove sod in rolls of suitable size for handling and keep moistened until replanted. Replant sod within 7 days after removal, roll and water generously. Replace damaged lawn areas and plants with new to match existing.

B. Where existing pavements must be cut to install irrigation system, cut smoothly to straight lines 6 inches wider than trench. Compact subgrade to 95% in six (6) inch lifts and then repair or replace pavement cuts with equivalent materials and finishes.

3.6 MAINTENANCE

A. The entire sprinkler irrigation system shall be under full automatic operation for a period of two (2) days prior to any planting.

B. The Landscape Architect reserves the right to waive or shorten the operation period.

C. Contractor shall be responsible for completion, modification, revision and adjustment of the system as necessary to maintain consistent coverage design.

3.7 CLEAN-UP

A. Clean up as each portion of work progresses. Remove refuse and excess dirt from the site. Paving shall be swept clean or washed down. Repair damages incurred on the work of others and restore to original conditions.

3.8 REVIEWS PRIOR TO ACCEPTANCE

A. Notify the Landscape Architect in advance for the following reviews, according to the time indicated:

1. Pre-construction conference - 7 days.
2. Supply line pressure test and control wire installation - 72 hours.
3. Coverage and controller test - 72 hours.
4. Final review - 7 days.

B. No reviews will commence without record drawings. In the event the Contractor calls for a review without record drawings, without completing previously noted corrections, or without preparing the system for review, he shall be responsible for reimbursing the Landscape Architect at the rate of two and one-half times the normal office hourly rate per hour portal to portal (plus transportation costs) for the inconvenience. No further reviews will be scheduled until this charge has been paid.

3.9 FINAL REVIEW

A. Operate each system in its entirety for the Landscape Architect at time of final review. Any items deemed not acceptable by the Landscape Architect shall be reworked to the complete satisfaction of the Landscape Architect.

B. Provide evidence to the Landscape Architect that the Owner has received all accessories and equipment as required before final review can occur.

END OF SECTION

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

WARRANTY FOR IRRIGATION SYSTEM

We hereby warrant that the irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the Drawings and Specifications, ordinary wear and tear and unusual abuse, or neglect expected. We agree to repair or replace all defects in material or workmanship which may develop during the period of one (1) year from date of acceptance and also to repair or replace any damage resulting from the repairing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefor upon demand.

PROJECT: _____

LOCATION: _____

CONTRACTOR: _____
Company License #

ADDRESS: _____

_____

PHONE: (_____) _____

DATE OF FINAL ACCEPTANCE: _____

Name _____

Signed _____ Date _____

INTERMOUNTAIN HEALTH
UTAH VALLEY SPORTS PERFORMANCE CENTER
PROVO, UTAH

SECTION 329000

GENERAL PLANTING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Common procedures and requirements for landscaping work.
2. Furnish and install landscaping plants as shown in Contract Documents.

B. Related Sections:

1. Section 312000: Earth Moving
2. Section 328400: Irrigation System
3. Section 329119: Topsoil

1.2 REFERENCES

A. American Nursery & Landscape Association / American National Standards Institute:

1. ANLA / ANSI Z60.1-2004, 'American Standard for Nursery Stock.'

1.3 SUBMITTALS

A. Samples: Submit one pint of each type of top dressing mulch for approval before delivery to site.

B. Quality Assurance / Control:

1. Pre-Bid Submission: Landscape Company's certification of qualifications specified herein.
2. Pre-Bid Submission: Include with submission an itemized list of materials with quantities and units of measure of bark topdressing mulch, fertilizers, turf seed, plants, stakes, herbicide, topsoil, and other landscaping materials anticipated to complete work of this Section. Purpose of submittal is to verify accuracy and consistency of interpretation of Contract Documents by each bidder.
3. Product Data: Submit copy of manufacturer’s current catalogue cut sheets and specification of the following.

   a. Mulch.
   b. Fertilizer.
   c. Herbicide.
   d. Tree guying equipment.

4. Verification of plant and shrub quantities and report of discrepancies: Within 30 days of contract award, provide written guarantee from plant supplier that trees and shrubs specified will be reserved and held for this project. Include location where materials will be held.

C. Closeout: At completion of landscape work, submit three copies of typewritten instructions to the Landscape Architect recommending procedures to be established by Owner for maintenance of landscape work for one full year after contract maintenance period ends.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Landscaping Company:

a. Landscaping Company shall be required to produce certification of following requirements within 5 days after bid opening:

1) Have been in business for period of minimum five years while providing quality of labor and materials specified in this section.
2) Provide evidence of having completed minimum five projects of scope and quality of this project type in a timely manner.
3) Provide certifiable list of reputable landscape suppliers from whom it will be purchasing materials to be used on this project.
4) Provide evidence of employing quality employees with specified experience and in a quantity sufficient to perform work of this section within time limits established by Contractor.

2. Workers:

a. Trained personnel familiar with required planting procedures and Contract Documents shall perform planting.
b. Planting shall be performed under direction of foreman or supervisor with minimum five years' experience in landscape installations.

B. Preconstruction Conference:

1. Schedule planting preconstruction conference after completion of section (312000 Earth Moving) and before beginning landscape work. In addition to requirements of other specified administrative requirements.

a. Establish responsibility for maintenance of new landscaping during all phases of construction period.
b. Prepare five (5) typical landscape planting excavations which are representative of all areas and conditions throughout the project and conduct percolation test to verify that water drains from the hole. Fill each hole with water 18-24" deep and verify that water drains away at a rate of 3 inches per hour or greater. Discuss results of percolation tests with Construction Manager and Owner's representative.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver sports field turf seed and trees in healthy and vigorous condition free from disease and/or insects. Store in location on site where they will not be endangered and where they can be adequately watered and kept in healthy and vigorous condition.

1. Do not prune or top trees prior to delivery.
2. Protect bark, branches, and root systems from sun scald, drying, whipping, and other handling and tying damage.
3. Plants with broken rootballs are not acceptable.

4. Do not bend or bind-tie trees in such a manner as to destroy natural shape.
5. Provide protective covering during delivery.

B. Handle balled stock by root ball or container. Do not drop trees during delivery.

C. Deliver trees after preparations for planting have been completed and install immediately.

1. If planting is delayed more than six hours after delivery, set planting materials in shade and protect from weather and mechanical damage.
2. If planting of B & B stock will not occur on day of delivery Set B & B stock on bare ground and heel in with soil, saw dust, or other acceptable material approved by Landscape Architect, until plant material can be immediately planted. Do not place on pavement.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of trees and shrubs stored on site with fine spray. Water as often as necessary to maintain root systems in moist condition. Do not allow plant foliage to dry out.

D. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

1.6 SEQUENCING

A. Do not install plants until major construction operations are completed. Do not commence landscaping work until work of Section 328400: Irrigation System has been completed, and is operable and approved. In the event that irrigation water in not available on site, otherwise water all plants to ensure proper establishment.

B. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

C. Delays: Delays caused by the contractor in completing planting operations which extend the planting into more than one planting season shall extend the warranty period correspondingly.

1.7 WARRANTY

A. Provide written warranties confirming following:

1. Furnished plant material guaranteed to live and remain in strong, vigorous, and healthy condition for 90 days minimum from date landscape installation is accepted as complete.
2. Trees guaranteed to live and remain in strong, vigorous, and healthy condition for one year from date landscape installation is accepted as complete.
3. All plant material shall be true to the species and variety indicated on construction drawings.
4. Replacements: as soon as weather conditions remit, replace, without cost to Owner all dead plants and all plants not in vigorous, thriving condition, as determined by Landscape Architect during and at the end of Warranty Period.
5. Exclusions: Contractor shall not be held responsible for failures due to neglect by owner, vandalism, and natural disaster, during Warranty Period. Report such conditions to owner and landscape architect as soon as discovered.

1.8 REPLACEMENTS

A. Failed Materials:

1. Repair and/or replace at no cost to the Owner all Plant materials exhibiting condition which are determined unacceptable due to workmanship by the contractor.
2. Closely match replacements to adjacent specimens of the same species. Apply requirements of this specification to replacements.
3. Contractor to be held responsible for a maximum of two (2) replacements for each failed tree, shrub, and vine, and same area of groundcover planting after final acceptance during warranty period.

B. Incorrect Materials:

1. During Warranty Period, replace at no cost to Owner plants revealed as being untrue to name and species.
2. Provide replacements of a size and quality to match the planted materials at the time the mistake is discovered.

1.9 WARRANTY PERIOD MAINTENANCE PLAN

A. Provide written instructions and training to Owner's maintenance personnel covering maintenance requirements by Owner for first year of operation after landscape installation is accepted as complete. Contractor to submit written instructions to Owner's representative and Architect for approval prior to final inspection and approval.

B. Provide instructions for Owner's maintenance personnel to contact the installing contractor immediately should there be any warranty issues (such as unhealthy plants or irrigation issues) or other items of concern that fall under the installing contractor's warranty – all warranty items are the installing contractor's responsibility during the maintenance period.

C. Plan shall include the following items:

1. Contact Information.
2. Other items as deemed necessary for the project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plants:

1. Conform to requirements of Plant List and Key on Drawings and to ANSI Z60.1: National Standard for Nursery Stock.
2. Nomenclature: Plant names used in Plant List conform to 'Standardized Plant Names' by American Joint Committee on Horticultural Nomenclature except in cases not covered. In these instances, follow custom of nursery trade. Plants shall bear a tag showing the genus, species, and variety of at least 100 percent of each species delivered to site.
3. Quality:

a. Plants shall be sound, healthy, vigorous, free from plant disease, insect pests or their eggs, noxious weeds, and have healthy, normal root systems. Container stock shall be well established and free of root-bound conditions.
b. Do not prune plants or top trees prior to delivery.
c. Plant materials shall be subject to approval by Architect as to size, health, quality, and character.
d. Bare root trees are not acceptable.
e. Provide plant materials from licensed nursery or grower.
f. Plants shall be sound, healthy, and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae. They shall have healthy, well developed root systems. Plants shall be free from physical damage or adverse conditions which would prevent thriving growth.
g. Condition of Root System: Samples must prove to be completely free of circling, kinked, or girdling trunk surface and center roots and show no evidence of pot-bound condition. Upon inspection by Landscape Architect at job site, if five (5) percent or more of the plants of each species are found to contain kinked, circled, or girdling roots, all plants of that species will be rejected.
h. Dig B & B plants with firm, natural balls of earth of diameter no less that that recommended by USDA Standard for Nursery Stock, and of sufficient depth to include the fibrous and feeding roots. Wrap and tie as required to prevent all cracking of loss of soil from rootball.

4. Measurements:

a. Measure height and spread of specimen plant materials with branches in their normal position as indicated on Drawings or Plant List.
b. Size Range: Do not use plant materials that are less than the minimum size specified on the drawings. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected. Plants properly trimmed and transplanted should measure the same in every direction.
c. Take caliper measurement at a point on the trunk 6 in. above natural ground line for trees up to 4 in. in caliper.
d. Plant materials larger than those specified may be supplied, with prior written approval of Architect, and:

1) If complying with Contract Document requirements in all other respects.
2) If at no additional cost to Owner.
3) If sizes of roots or balls are increased proportionately.

5. Shape and Form:

a. Plant materials shall be symmetrical or typical for variety and species and conform to measurements specified in Plant List.
b. Well grown material will generally have height equal to or greater than spread. However, spread shall not be less than 2/3 of height.

6. Unacceptable Trees:

a. Trees that have damaged or crooked leaders will be rejected. Trees having a main leader shall not have been headed back. Trees with abrasions of the bark,

sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4 in. which have not completely callused, will be rejected.

B. Pruning: do not prune plants before delivery. Consult Landscape Architect for pruning after installation.

C. Planting Mix: See Soil Preparation Section 329113.

D. Fertilizers:

1. Planting Tablets: 21 gram Agriform 20-10-5. N.P.K. slow release fertilizer.
2. Complete fertilizer, 50% of the nitrogen to be derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bone or tankage. Potash shall be derived from muriate of potash containing 60% potash.

   a. 16% Nitrogen
   b. 6% Phosphoric Acid
   c. 8% Potash

E. Tree Stakes:

1. Type Two Acceptable Products:

   a. 2 inch diameter Lodgepole Pine.
   b. Equal as approved by Architect before installation. See Section 012500 Substitution Procedures.

F. Tree Staking Ties:

1. Type Two Acceptable Products:

   a. 32 inch 800 mm Cinch-Tie tree ties by V.I.T. Products Inc, Escondido, CA www.vitproducts.com.
   b. Flex strap Tree Ties by Aquarius Brands Inc, Ontario, CA www.aquariusbrands.com.
   c. Equal as approved by Architect before installation. See Section 012500 Substitution Procedures.

G. Tree Guys:

1. Type Two Acceptable Products:

   a. Duckbill Model 68RK or 88RKB rootball guying kit.
   b. Equal as approved by Landscape Architect prior to product procurement and installation.

H. Pre-Emergent Herbicide:

1. Category Four Approved Products. See Section 016200 Product Options for definitions of Categories.

a. Chipco Dimension Granular by The Andersons Inc, Maumee, IL www.andersonsinc.com.
b. Elanco XL2G granular by Crop Data Management Systems, Marysville, CA www.cdms.net.
c. Ronstar G granular by Bayer CropScience, Monheim, Germany www.bayercropscience.com.
d. Surflan AS liquid by United Phosphorous Inc, Trenton, NJ www.upi-usa.com.
e. Oryzalin 4 A.S. liquid by FarmSaver, Seattle, WA www.farmsaver.com.

I. Top Dressing Mulch:

1. See plans for mulch

J. Water to be provided by onsite via irrigation system.

2.2 SOURCE QUALITY CONTROL

A. Review: Submit a written request for review of plant materials and quantity at place of growth at least thirty (30) days after award of contract. Right is reserved by owner/landscape architect to refuse review at this time, if, in his judgment, a sufficient quantity of plants is not available.

B. Transportation: Contractor shall accompany Landscape Architect to all review(s) of plant materials at the nursery. Landscape Architect will tag plants at place of growth and review upon delivery for conformity to specifications.

C. Distant Material: Submit photographs with a person adjacent to each plant type for preliminary review. Such review shall not impair the right of review and rejection during progress of the work.

D. Unavailable Material: If proof is submitted that a specified plant is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Substantiate such proof in writing no later than 30 days after award of contract.

E. Special Conditions: The above provisions shall not relieve contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect site and Contract Documents to become thoroughly acquainted with locations of irrigation, site drainage and other utilities. Verify that all grades are within one (1) inch plus or minus of required finish grade. Repair damage to these and other items adjacent to landscaping caused by work of this Section or replace at no additional cost to Owner.

B. Before proceeding with work, check and verify dimensions, quantities, topsoil depth, and that preparation is complete. Report variations between Drawings and site to Landscape Architect before proceeding with work of this Section.

C. Plant totals are for convenience only and are not guaranteed. Verify amounts shown on Drawings. All planting indicated on Drawings is required unless indicated otherwise.

D. Verify that irrigation systems have been installed and accepted prior to planting.

3.2 PREPARATION

A. Layout individual plant locations and areas for multiple plantings consistent with location shown on drawings. Stake locations and outline areas. Provide a minimum 48 hours' notice and secure Landscape Architect's acceptance before planting. Make minor adjustments as may be requested.

1. Right is reserved to refuse review at this time, if, in the Landscape Architect opinion, an insufficient quantity of plants is not available.

B. Protection:

1. Take care in performing landscaping work to avoid conditions that will create hazards. Post signs or barriers as required.
2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.
3. Keep site well drained and landscape excavations dry.

C. Locate and verify all underground utilities for conflicts with plantings prior to planting. Alert landscape architect.

D. Digging Plants Pits: Dig tree pits and scarify all sides of the tree pit after excavation – see below. Do not use an auger or tree spade.

3.3 INSTALLATION

A. Excavation:

1. Maintain grade stakes until parties concerned mutually agree upon removal.
2. When conditions detrimental to plant growth are encountered, such as rubble fill or adverse drainage conditions, notify Construction Manager before planting.
3. If underground construction work or obstructions are encountered in excavation of planting holes, Architect will select alternate locations.
4. Scarification:

a. Plant Rootball: After removing plant from container, scarify the sider of the rootball to a depth of one (1) inch at four to six equally-spaced locations around the perimeter of the ball or at 12 inches intervals on sider of boxed materials. Cut and remove circling roots over 3/8 inch diameter found in shrub plant material. Trees with circling roots are unacceptable, will be rejected and not to be installed. Contractor to procure acceptable tree of the same size and species as originally specified unless otherwise directed by Landscape Architect.
b. Plant Pit: Scarify sides of plant pit, thoroughly breaking up surfaces and eliminated "glazed" areas.

5. Unless excavated material meets topsoil requirements as specified in Section 312000, remove from landscape areas and do not use for landscaping purposes.
6. Roughen sides and bottoms of excavations.
7. Water Percolation Test:

a. Before planting, select five typical tree planting excavations throughout the site. Fill each hole with water 18-24” deep and verify that water drains away at a rate of 3 inches per hour or greater. Inform Architect in writing if water does not drain properly. Do not plant trees or shrubs in holes that do not properly drain.

B. Planting:

1. Removing Binders And Containers:

a. Remove top one / third of wire basket and burlap binders.
b. Remove plastic and twine binders from around the root ball, tree trunk and any additional branches or stems that have been wrapped or tied for transporting. All branch and stem binding material should be removed before trees are placed and installed upright.

2. Plant immediately after removing binding material and containers. Place plants in planting pits so, after watering and settling, top of root ball shall be approximately two inches higher than finished grade and trunk flare is visible for trees. Rootball for shrubs shall be approximately one inch higher than finished grade.
3. Properly cut off broken or frayed roots with clean sharp edge. Tease and loosen roots.
4. Center plant in planting pit and backfill with specified planting mix. Except in heavy clay soils, make ring of mounded soil around planting pit perimeter to form watering basin.
5. Add plant fertilizer tablets in plant pit as follows. Place tablets in relation to root ball as recommended by Manufacturer.

a. One Gallon Shrub: 1 tablet.
b. 5 Gallon Shrub / Tree: 3 tablets.
c. 15 Gallon Tree: 4 tablets.
d. 24 inch Box Tree: 6 Tablets.

6. Fill landscape excavations tamped planting mix. Settle by firming and watering to ensure top of ball one inch higher than surrounding soil.
7. Do not use muddy soil for backfilling.
8. Make adjustments in positions of plants as directed by Architect.
9. Thoroughly water plants immediately after planting.
10. At base of each tree, leave 36 inch diameter circle free of any grass.

C. Support for New Trees:

1. See drawings.

D. Post Planting Weed Control:

1. Apply specified pre-emergent herbicide to shrub planting areas and grass-free areas at tree bases after completion of planting.
2. Areas shall be free of existing weed growth prior to application of herbicide.

E. Mulching:

1. After application of herbicide, mulch shrub and ground cover planting areas with mulch per plans. See Mulching Specification 32 9116.
2. Place mulch to uniform depth and rake to neat finished appearance.

3.4 FIELD QUALITY CONTROL

A. Inspection:

1. Do not install plants or sports field turf seed until after inspection of current site conditions and plant material by Construction Manager to verify they are in healthy and vigorous condition. Notify Construction Manager 48 hours' minimum before placing or installing plants and turf seed.

3.5 ADJUSTING

A. Promptly replace damaged plantings at no additional cost to Owner as weather permits.

3.6 CLEANING

A. Immediately clean up soil or debris spilled onto pavement or finished landscaping and dispose of deleterious materials off of site.

3.7 PROTECTION

A. Protect planted areas against traffic or other use immediately after planting is completed by placing adequate warning signs and barricades.

B. Provide adequate protection of planted areas against trespassing, erosion, and damage of any kind. Remove this protection after Construction Manager has accepted planted areas.

END OF SECTION

SECTION 329113

SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Perform soil preparation work as described in Contract Documents.
2. Furnish and apply soil additives as described in Contract Documents.

1.2 REFERENCES

A. American Society For Testing And Materials:

1. ASTM 1557-02, 'Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.'

1.3 SUBMITTALS

A. Product Data: Product literature and chemical / nutrient analysis of soil amendments and fertilizers.

B. Samples: Sample of soil conditioner and topsoil for approval before delivery to site. Include product analysis list and topsoil test report.

C. Quality Assurance / Control: Delivery slips indicating amount of soil conditioner delivered to Project site.

1.4 QUALITY ASSURANCE

A. Pre-Installation Conference: Participate in pre-installation conference specified in Section 312213.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Incorporate following soil amendments into topsoil from site used for Project:

1. Acceptable Soil Amendments, Soil Conditioners, and Application Rates:

a. Add fertilizers at application rates as recommended from Topsoil Testing Report.
b. GroPower Plus soil conditioner.

1) Provide150 lbs. per 1000 square feet.
2) GroPower Inc., Chino, CA (800) 473-1307 or (909) 393-3744.

c. EPA Class 'A' co-compost or compost with SAR less than 3.0, EC less than 4.0, and CN ratio of 15 to 25:1 passing through 1/2 inch mesh screen or other product approved by Architect before use.
d. Equal as approved by Architect before installation.

2. Acceptable Fertilizers And Application Rates:

a. Add fertilizers at application rates as recommended from Topsoil Testing Report.
b. Equal as approved by Architect before installation.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Add specified soil amendments at specified rates to lawn areas. Roto-till or otherwise mix amendments evenly into top 4 inches of topsoil. Incorporate and leach soil amendments which require leaching, such as gypsum, within such time limits that soil is sufficiently dry to allow proper application of fertilizer and soil conditioners.

END OF SECTION

SECTION 329113.16

MULCHING

PART 1 - GENERAL

1.1 SUMMARY

A. The work to be performed shall consist of furnishing and placing mulch, including site preparation, edging, and weed control fabric.

B. Related Sections:

1. Section 329000: General Planting Requirements.

1.2 QUALITY ASSURANCE

A. Any deviation from the contract documents shall have written approval of owner and Landscape Architect.

1.3 SUBMITTALS

A. Product Data: Contractor shall furnish sample of mulch to Landscape Architect prior to placing to approve color, size and content.

PART 2 - PRODUCTS

2.1 GRAVEL MULCH

A. Gravel mulch shall consist of crushed rock product as specified on the construction drawings. Color, size and shape shall match that of selected rock.

B. Contractor shall submit a 2 kg sample of gravel mulch to the Landscape Architect for approval prior to delivery of materials to the site.

2.2 WEED CONTROL FABRIC

A. Acceptable Products:

1. DeWitt weed barrier 20-year woven polypropylene fabric.
2. Polyspun Weed Control Fabric - 3.5 oz. polyester fabric.

B. The Contractor shall submit a 12” by 12” sample of fabric to the Landscape Architect for approval prior to delivery of materials to the site.

C. A copy of the manufacturer’s product sheet together with instructions for installation shall be furnished to the Landscape Architect 5 days before installation.

2.3 STAPLES

A. Fabric staples shall be 1.5 inches wide, 6 inches in length, and 11 gauge wire.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before proceeding with work, check and verify dimensions and quantities. Report variations between Drawings and site to Landscape Architect before proceeding with work of this Section.

3.2 PREPARATION

A. Clear trash, debris and vegetation from areas to receive mulch, as specified under SECTION 311000 Site Clearing.

B. Excavate to the depth shown on drawings, grade to a smooth surface, and compact to minimum 90% relative compaction. Soil surface shall be smooth, firm stable and free of rocks, clods, foliage, roots or other material greater than one inch in diameter. Earthwork shall conform to the provisions in SECTION 312000 EARTH MOVING.

C. Treat sub base with pre-emergent herbicide.

3.3 PLACEMENT

A. Place weed control fabric only under areas to receive gravel mulch. Place fabric loosely with longitudinal and transverse joints overlapped 6 inches. Fabric shall lay flat, smooth and be in uniform contact with the soil surface, without bulges or wrinkles. Staple or stake fabric in place to keep it stable during gravel mulch placement and compaction.

B. End weed barrier fabric and mulch 4" from tree and/or shrub trunks. Maintain 8" diameter space around trunk(s) to avoid girdling plant trunks with weed fabric and mulch.

C. Edging shall be installed to delineate the limits of the gravel mulch areas as shown on the plans. Edging is not required between gravel mulch areas and the adjacent face of walls, pavement, curbs, or rock blanket areas. Gravel mulch limits are shown on the plans.

D. Place mulch as a single layer to depth shown on Drawings.

E. Finished elevation of the mulch shall be equal to adjacent finish grade. Acceptable tolerance is ½” difference for bark mulch and ¼” difference for gravel mulch.

F. Final surface shall be uniform and maintain original flow lines, slope gradient and contours of the project site.

END OF SECTION